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AND OF

THE INSTITUTIONS IN UNION.

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Announcements by the Council.

CANTOR LECTURES.

The Second Course of Cantor Lectures, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows:—

FEB. 13TH.—LECTURE 2.—On Natural and Artificial Springs, and on the various Sources of Water Supply for Towns and Cities, in connection with the Geological Structure of the Vicinity.

FEB. 20TH.—LECTURE 3.—On Mineral Materials used for the Purposes of Construction: Plastic and Incoherent Materials (Clays and Sands).

FEB. 27TH.—LECTURE 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

MARCH 6TH.—LECTURE 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture. For this purpose a set of Tickets has been sent to every member.

FINAL EXAMINATIONS—BOTANY.

In addition to the Prizes in this subject offered by the Society of Arts to candidates taking a Certificate of the First Class, the Royal Horticultural Society offers five prizes, of £5, £4, £3, £2, and £1 respectively, to the five candidates being gardeners by profession, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject at the Final Examinations in April next.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

FEB. 15.—"On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions." By THOMAS WEBSTER, Esq., Q.C., F.R.S.

FEB. 22.—"On the Municipal Organisation of Paris, especially with reference to Public Works." By GEORGE R. BURNELL, Esq., F.G.S.

INSTITUTIONS.

The following Institutions have been received into Union since the last announcement:—

Rawtenstall Mechanics' Institution.
Tottington (near Bury) Mutual Improvement Society.

Proceedings of the Society.

CANTOR LECTURES.

SECOND COURSE.—FIRST LECTURE.—MONDAY, FEB. 6.

Professor ANSTED commenced by stating that he proposed, in these lectures, to introduce the subject of the various practical applications of geology. He was aware of the difficulties; for, on the one hand, the facts were so numerous that if merely enumerated and tabulated they could not all be placed before his audience in the time at his disposal; and, on the other hand, if he were to generalise without facts and statistics, he could not expect that the great importance of his conclusions should be appreciated. He considered that an account of the working out of the great theorems of geology, and their bearing upon agriculture, architecture, engineering of all kinds, and mining of all kinds,—their influence on the progress of the arts of construction, and on the discovery of the material of which things are constructed, could not want interest, and need not be useless because it was brief. In treating of the applications of geology, it would be convenient to take advantage of certain natural divisions which the subject offers. The earth was both the place itself on or within which everything was done, and it yielded all the material by which everything was done. We had to employ the earth as it was presented to us by nature, and to do so we had to discover and remove from the earth the means of using this same earth to

advantage. On the applications of geology, that which had reference to agriculture was the one to be considered this evening. It was one involving many details and many principles. On the part of those who entered on the subject, a certain knowledge of geology must be presumed, but the lecturer thought it well to lay down, in a few words, in mere outline, a statement of those facts that were chiefly concerned in its reduction to the use of common life. The surface of the earth, in the cultivated parts of a country, consisted of vegetable soil. In parts where the soil was barren this might be sand or stones, but it concealed the rock. In a fertile district only a very small proportion of the surface exposed the rock to view. In England, almost everywhere on the east side of the country there was soil of some kind; while on the western extremity there were large tracts of barren rock. Every country had its own *facies* in this respect, and even where soil existed its thickness and general character were very variable. Whatever the thickness might be, however, there was always a termination to the soil, and below it was a subsoil partaking of a mixed character, between soil and rock, while below the subsoil was the rock, often exposed in quarries and railway cuttings, or in fragments brought up when water was sought for. Even the channel cut through by a stream, however small, would often be found to give a geological section. Rocks were of various kinds, but the varieties might be included within certain general and familiar terms. Such were limestone, sandstone, clay, granite, basalt, slate, &c. Mixed fragments of these formed gravel when loose, and conglomerates or pudding-stones when cemented together. More minute fragments ground to powder were sand. Of these, some were stratified, others unstratified. So, again, some were aqueous, others igneous. Others, again, and these were very numerous, might or must have been formed with water, but were now so far changed as to have lost their aqueous character. These were metamorphic. Limestone was an aqueous rock, and stratified. Basalt was an igneous rock, and might or might not be in strata. Slate was an aqueous rock, but metamorphic. Granite was metamorphic, and generally unstratified. Stratified rocks were generally tilted, and it was even possible that beds once horizontal might be actually inverted, and made to dip the wrong way. Rocks occurred in series. Often a multitude of stratified rocks were found in the same district, some of them being much more tilted than others. Stratified rocks were often interpenetrated by those that are metamorphic or igneous, but sometimes the metamorphic and igneous would alternate with the aqueous. Such were some of the simplest and most significant facts of geology bearing on those practical questions to be considered in these lectures. Rocks were the mineral constituents of the earth beneath any vegetable soil that might have accumulated upon them. They would yield to the chemist a ready account of their composition, and to the tudent investigating them for that purpose, a clear outline of the mechanical changes they had undergone; while they were often sufficient to enable the geologist to determine a complete outline of events, and a history of changes that may have taken a long time to complete. Owing to the mixed origin of rocks, it had happened that most rocks were broken and fractured, the cracks being filled up more or less completely with minerals, generally crystalline. Every kind of vegetable soil was once rock, which had been broken down by degrees into fragments, until at last it was reduced to mud. The part of this process performed by the atmosphere was called weathering. Wherever rock was exposed to the air, it became weathered; and weathering meant ultimately a reduction to fine powder. On granite or quartz rock, a group of small lichens was seen to grow. These were insidious enemies, as, although they derived their nourishment chiefly from the atmosphere, and might be thought even to protect the exposed surface from the weather, they paved the way for destruction. That which they separated from the air became a brown pulverulent mass, or *humus*, which afforded nourishment to larger individuals of the same tribe. Mosses succeeded lichens, and small crevices received their roots. Once inserted, these roots expanded, splitting asunder the rock. Other roots were thus enabled to penetrate yet further; and after a time the mosses were followed up by heather, grasses, and small shrubs; until at length there was attained a sufficient thickness of soil to enable trees to grow, thrusting down their rootlets in the crevices and making room for the admission of rain. Then frost coming, rending asunder the rock, which would fall into the valleys below, spread over the surface and being lost sight of, being washed away by the rain. In certain soils the underlying rock was found in situ, in angular fragments and recognizable; elsewhere the fragments were water-worn, and belonged to some distant mountain or hill. This transported material was more common than the other, for water had everywhere been at work. Thus alluvial soils were formed. The solvent power of water was a very important agent in weathering. On detached fragments of limestone, water and vegetation together acted as a drill. Of sandstones it dissolved the calcareous cement, or even the silica itself. Thus in a mixed rock, as basalt, great differences of composition existed between an unweathered and a weathered specimen, and in a particular case referred to, 65 per cent. of the soluble alkalies had been removed, 28 per cent. of the alkaline earths, nearly 20 per cent. of the silica, only 2½ per cent. of the iron oxide, and no appreciable quantity of the alumina. Productive soils were composed partly of mineral substances and partly of certain products of the decomposition of organic bodies. This latter portion was called *humus*. It consisted largely of carbon, and carbonic acid was mixed freely with the water that passed through fertile soil. Humus was not generally present in soils in large proportion, but was abundant in peat and moor soils. The mineral constituents of a soil were of two kinds: the one kind we might call earth, as being a disintegrated mineral substance, the other consisted of fragments of the rock from which the earth was derived. The latter we might call stones. The former rendered the ground arable; the latter increased the bulk of the soil and facilitated the action of rain and frost, but contributed nothing to nutrition. Clay, lime, and sand formed the staple of all rocks, and were the ingredients of chief importance in every cultivable soil. Clay was a silicate of alumina, capable of retaining a large quantity of water, forming with it a tenacious, compact, sticky paste, which was almost impermeable to water. Hence soil containing much clay was heavy and difficult to work, remaining wet when soaked, and caked at the surface, allowing the water to descend very imperfectly. Cold and wet places were formed underground when clay existed below a good vegetable soil, and the roots of trees and plants reaching this water were poisoned. Wet clay would contract on drying, cracks forming in it after drought. The changes that prepared a soil for sowing were then checked in such material, or were only enabled to come about slowly. Frost would break up the clods, and sand improve the quality; but a deep clay soil was very difficult to improve. Mechanical admixtures with ashes and soot, as well as with sand, were suitable to such soils. Clays contained much potash, some phosphoric acid, and lime. They would also absorb ammonia and aqueous vapour from the atmosphere, and fix the ammonia very effectually. They were thus regarded as powerful and rich. When slightly burnt they became mellow. In England clay lands had been effectually improved by various methods, and had become extremely valuable and fertile, especially for wheat crops. Drainage opened the way for the permanent improvement of clay soils. Clays were largely derived from felspars. Granite, gneiss, basalt, clay-slate, and other metamorphic and igneous rocks yielded little else than clay soils. Loam was clay mechanically mixed with sand. The quantity of free silica that might exist in a soil without removing from it

the usual characteristics of clay was enormously large. Sand was the least changed of all rocks by weathering. Sandstones were changed by the destruction of the cement that holds them together, but the actual particles changed only by mechanical abrasion. Sand was an accumulation of granules of quartz, lying loosely beside one another, leaving abundant interstices admitting the free passage of water. Water was only retained in sands near the surface in small quantities. Light soils, containing much sand, had a hot, dry nature, giving up moisture rapidly during warm weather, and being readily heated by a summer sun. So again, these soils were active but soon exhausted. When sand was present in an exceedingly fine mealy state it approached clay in its properties, forming a dense compact mass, and holding water. This transition was a very curious fact, and one often insufficiently regarded. Common limestone was a carbonate of lime, exceedingly soft, and readily acted on in the state of chalk, but harder and more stony in the oolites and other building stones. Limestones would work up into soils red in colour, and cracked and broken by weathering near the surface. Magnesian limestone consisted of a carbonate of lime and magnesia, the proportions being variable. It was less capable of supporting abundant vegetation than common limestone. All limestones were permeable to water, and contained a considerable per-centage of it. Chalk was especially absorbent, and acted like a sponge. A calcareous or lime soil was soft to the touch, standing in this respect midway between clay and sand. It would absorb and retain water, but would not become sodden. Its tenacity was greater than sand, but less than clay. It would shrink much less than clay, but would not crack. It would diminish the tenacity and humidity of clay soils, rendering them more porous, more accessible to air, and warmer. Where, however, lime greatly preponderated, the soil was poor and hot; but these characters were readily altered by the admixture of clay and humus. Every soil would support some vegetable growth, much of the difference depending on the mechanical condition of the soil, and much on the chemical composition. Both were due to the underlying rock. To produce a productive soil, in the first place, certain conditions must be avoided. First, too great cohesion. A soil, otherwise productive, might be rendered unproductive if washed by rain into hollow bottoms, where it would cake into a solid, impenetrable mass. Secondly, want of cohesion. A soil might be too coarse, too loose, and too open. Thirdly, poisonous ingredients. This cause was rare, but it existed. The salts of lead and copper were absolutely poisonous in all proportions. Sulphate of iron was also poisonous, and alum might be regarded in the same light. Lastly, the excess of some nutritious ingredients. Thus, common salt was used as a mineral manure, but salt water would entirely destroy vegetation. Mineral acids also interfered with growth, and would destroy vegetable life, if in too large proportion. To make a soil productive, it should possess, first, a soft consistence, unchanged by the operations of tillage. In the next place, the soil must furnish the plant with food essential to its existence in a digestible form. Among the important mineral constituents of a soil were—phosphoric acid, potash, lime, and magnesia. The quantity of these was variable, but the following statement of the limits would be useful as a guide, being given on the authority of Dr. Stöckhardt, a Saxon chemist:—

An Acre of Land, six inches deep, would contain about:—	Maximum.	Minimum.	Mean of predominating Rich Soils.
	Pounds.	Pounds.	Pounds.
Phosphoric acid	12,000	150	2,500
Potash (total quantity).	53,000	1,500	22,000
Soluble potash	15,000	750	3,500
Lime and magnesia ...	145,000	900	30,000

This estimate would show the relative importance of these substances. The most important was phosphoric acid, for without it nourishing food could not be grown and ripened. Of other substances, sulphuric acid must be present, but of it there was generally no want. Silica also was essential and was always present. To learn the proportion needed we must refer to the constituents of the ashes of plants. These would show that some species contain in the ashes of one thousand pounds of dried plants only two pounds of lime and magnesia, half a pound of potash, and only a quarter of a pound of silica. Of meadow grass, however, the ashes contained sixty-four times as much phosphoric acid, thirty-four times as much potash, four times as much lime and magnesia, and eighty times as much silica, as in the case of coniferæ; while wheat contained the same proportion of silica as grass, but much less phosphoric acid, potash, lime, and magnesia. Particular soils were thus favourable for certain crops; forest land that had been so from time immemorial, and was put under another cultivation, was rich; certain soils, unfavourable for particular crops, might once have been the contrary. A productive soil should be composed of nearly equal parts of the three earths—sand, clay, and lime; it should contain decomposing vegetable and animal matter; it should imbibe moisture and give it back to the air without much difficulty; it should have depth sufficient to permit the roots of plants to sink and extend without coming to rock, to water, or to some injurious earth; the subsoil should be moderately porous, and should be able to improve the soil by mixture with it. The proper proportion of the various earths might vary from 50 to 70 per cent. of silicious matter, 20 to 40 per cent. of clay, and 10 to 20 per cent. of calcareous matter. The earth would bear a constant succession of crops of the same kind, if the mineral ingredients removed by one crop were supplied in the same state from year to year. But this could only be done as the result of a nice calculation, and by careful and systematic farming. As a remarkable instance of the successful use of mineral manures in rendering an ordinary soil capable of bearing, the lecturer quoted the experiments carried on at Rothamsted by Mr. Lawes and Dr. Gilbert.* The general result was that the average annual yield, without manure, was much the same over the whole period (of twenty years); that where ammonia salts and all mineral constituents were liberally supplied every year the produce of corn increased and that of straw somewhat diminished; and that where an excess of every constituent required by the crop was annually supplied, by farmyard manure, the rate of increase from year to year was not so great during the later as during some of the earlier years. Analyses of soils were very suggestive. The lecturer mentioned the component parts of some extremely rich soils, but he pointed out that few ordinary soils contained within them such great natural resources. Many that were very valuable under careful management and continued culture, would be almost valueless if left to themselves. The treatment that would best succeed in improving a soil must depend on the subsoil, the climate, and the facilities that exist for obtaining at a reasonable cost the required mineral manures. Among mineral manures the most important were those which supply phosphorus and nitrogen to the growing plant or ripening seed. These were especially necessary for food plants. The want of nitrogen was usually supplied by animal manure; but this was costly, and not always obtainable at the right time in proper quantity, and in the best state. Nitrate of potash, or saltpetre, was known to be a highly efficacious substitute, as well as *cubic nitre*—a nitrate of soda, of which very large quantities were obtainable. This material appeared to be the best and readiest means of communicating nitrogen to growing plants. It was now many years since attention was directed to the phosphates of lime from Estremadura, in Spain, and Dr. Daubeney, ac-

* See *Journal R. Agricul. Soc.*, Vol. xxv.

companied by Captain Widdrington, undertook to decide whether it could be economically worked and conveyed to England. They found a bed consisting of several bands of tolerably pure phosphorite. The thickness of the purer part was about 3 feet, and it was traced on its line of outcrop for about two miles, but the distance from any place at which it could be shipped for exportation, and the cost of transport, rendered its existence useless for practical purposes. Other places were mentioned where this substance had been obtained. Limestone and gypsum were occasionally used as mineral manures. Much more usually, marling, manuring with mud, and warping or bringing on the surface muddy water, and leaving it there to deposit a slime, were resorted to. Another important department of practical agriculture was drainage. It was impossible to exaggerate the importance of water, but it was desirable to regulate its application, and remove it when in excess. Drainage performed this by acting both upon and below the surface, and allowing the water to run off by natural channels. The effect of ploughing was to disturb the ground and expose it to the air, but it was not till drain-pipes were laid that the soil could be said to be available for high cultivation. Drainage was chiefly important in heavy clay lands. Geological maps were most useful in regulating draining operations.

TENTH ORDINARY MEETING.

Wednesday, February 8th, 1865; EDWIN CHADWICK, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society :—

Edwards, Henry, 53, Berkeley-square, W.
Lambert, Charles, 3, Queen-street-place, E.C.
Runtz, John, Burlington-house, Stoke Newington, N.
Saunders, Samuel, 22, Sussex-gardens, Hyde-park, W.

The following candidates were balloted for and duly elected members of the Society : —

Bonnerjee, W. C., 108, Denbigh-st., St. George's-rd., S.W
Hill, Frederic, The General Post Office, E.C.
Peckett, George, 10, Aberdeen-park, Highbury, N.
Perkins, Houghton, 25, Mortimer-street, W.
Robinson, Noel Hooke, 6, Great Queen-street, S.W.
Rodger, Captain William, R.N., 9, Shawfield-street, King's-road, S.W.
Sancton, Philip, 28, Cumberland-ter., Regent's-pk., N.W.
Smith, Colonel John Thomas, R.E., 27, Cannon-st., E.C.
Stone, George Graham, 78, Holland-park, W.
Sudlow, John J. J., 8, Manchester-buildings, S.W.
Thompson, Thomas C., 42, Belsize-park, N.W., Sherburn Hall, Durham.
Tomline, William, 5, Whitehall-yard, S.W.

The adjourned discussion on the paper, "London Sewage from the Agricultural Point of View," read by John C. Morton, Esq., at the last meeting, was resumed by

Professor VOELCKER, who said he thought the views expressed in the paper of Mr. Morton had received the general approbation of all who had given a thoughtful interest to the subject of sewage in its agricultural bearing. They were called upon to discuss it from this point of view only, for although there had been a great many discussions on the subject of sewage, yet he contended that in its agricultural bearing it had not been sufficiently ventilated. People had devised schemes without inquiring, in the first place, into the character of the soil which was fit for the reception of the sewage, and hence resulted such great diversity of opinion as to the quantity of sewage which might be appropriately applied to land, some contending for small and others for large quantities. In his opinion this question could have been settled long ago if the character of the particular land to be treated had been carefully kept in view Some regarded sewage as a universal manure, fit for every kind of soil, and applicable to every kind of crop. Though he was far from contending that sewage should be applied to grass land alone, he agreed with Mr. Morton that this should be its principal application, but there were cases in which he thought it might be applied to root crops, especially to mangel, which, being provided with a very large leaf surface, evaporated a considerable quantity of moisture, and would appropriate to itself a large amount of sewage. But in the first place they had to inquire into the character of the soil which was most appropriate for the reception of the sewage. He knew perfectly well that there was land in England that did not stand so much in need of manure as of thorough deep cultivation; there were soils which had such immense stores of mineral food that it only required to be developed by the application of special manures in order to produce very large and remunerative crops. It was on such rich clay lands, he believed, sewage never had been and never could be applied with advantage. They had clay soils in this country which were ungrateful for every description of manure, but were most grateful for the steam plough, draining, subsoiling, and all other modes of deep cultivation: and the reason why sewage did not answer for those rich clay soils was, because the fertilizing substances supplied to the soil by the sewage were insignificant in comparison with what the soil already contained. Besides, if a large quantity of water was applied, the excess of moisture did more harm than good to the growing crops. With regard to experience in the application of sewage to clay soils, he could name several landed proprietors who were great enthusiasts for the application of liquid manure, and who had constructed large tanks, and had most thoroughly carried out the experiment, not only on grass land, but on root crops, but had generally signally failed. But let them look at the other extreme. They found in some cases soils so poor, that they required large stores of every kind of mineral and organic matter to be supplied, and these were the soils on which, no doubt, sewage might be used with great advantage. In fact, it might be laid down as a rule that the poorer the soil was, the more successful the application of sewage was likely to be. In the case of such soils, too, they were not to use merely what appeared sufficient on calculation, but something like a hundred or two hundred times as much. Let them here again take actual agricultural experience for their guide. They found that on some soils they could raise very heavy crops of turnips by the application of a few cwts. of guano per acre, three or four cwts. of superphosphate, and a moderate dressing of farm-yard manure, whilst on poor sandy soils, 20 tons of farm-yard manure was considered a moderate dressing, being further augmented by a considerable quantity of superphosphate as well as guano. The quantities of manure to be put on the land should thus in a measure be regulated by the character of the soil. They knew they could raise, on moderate land, good crops by the application of a few cwts. of superphosphate and a few cwts. of guano, while on poor soil they required the same quantity of artificial manure, in addition to 20 tons of good rotten farm-yard manure. In this 20 tons of farm-yard manure they had an amount of phosphoric acid that could only be supplied by 14 cwt. of Peruvian guano; or if they wished to supply the amount of ammonia contained in these 20 tons of farm-yard manure, they would have to use 18 cwt. of guano; or, again, if they were to apply, in the shape of guano, the amount of potash contained in 20 tons of farm-yard manure, they would require to use 1½ ton of Peruvian guano; but no farmer in his senses would think of applying even 14 cwt. of Peruvian guano. If half that quantity were used on some soils, it would kill the crops outright. Hence they saw the poorer the soil was, the larger was the quantity of manure that should be put on the land, and that the quantity they took away in the crops, when harvested, was by no means an indication as to the quan-

tity that ought to be incorporated with the soil. There were many medium soils on which it would be possible to apply sewage with advantage, but then the quantity ought not to be so excessive as in the case of the poor lands, which would swallow up almost any amount of sewage with profit. These were matters of experience, and he thought, if they wished to make the best of London sewage, they ought to institute a very extensive series of experiments on the application of the sewage to lands of different degrees of fertility. He believed that much good would result if the character of the land were first taken into more consideration than had hitherto been the case. This was the point which he wished to bring prominently before the meeting.

Mr. S. SIDNEY said, in discussing the question of the application of London sewage to land, two points were to be considered, viz., quality and quantity. The latter was so enormous that it could hardly be made intelligible when expressed in tons or cubic feet, the daily supply being sufficient to cover an area of about 80 acres three feet deep, and that supply required to be disposed of day by day. With respect to the quality, it was not what they formerly anticipated, diluted with merely twelve gallons of water per head, but more nearly with forty or fifty gallons. He thought they were now past the time for theorising on this subject, inasmuch as they had twenty years' practical experience. He found that up to the present time there were nine towns in which attempts had been made to apply sewage to agricultural purposes—Alnwick, Croydon, Carlisle, Edinburgh, Malvern, Tavistock, Rugby, Watford, and Worthing. These towns furnished, upon the whole, the most successful results yet obtained of this application. At Edinburgh, large quantities had been applied to poor sandy soils with great results. It might be that in some degree, as was stated by Lord Robert Montagu, it was wastefully applied, but in the towns he had enumerated the success had been sufficiently great to induce other towns to imitate their example, and, at all events, to get rid of a nuisance if they did not make profits. At Alnwick, which was situated in a district subject to a very heavy rainfall, the system of sewage irrigation had been abandoned by the farmers. He did not consider that an argument against its use, but it rather pointed to the right mode of application. At the outset the application of the sewage by means of the pipe and hose system was generally in favour. The attempt was made to pump up everything; but those who were most enthusiastic in that system had abandoned it in favour of the Edinburgh meadow system, while the application of the sewage had been restricted to grass crops, to the almost entire exclusion of any attempts to apply it to cereal crops. One great reason for that was, perhaps, to be found in the fact that wheat was too valuable and important a crop to the farmer to be made the subject of experiment. With fair dressing and an average amount of rain, the farmer was pretty certain of a good wheat crop; therefore, though the application of sewage to the young crop of wheat would perhaps be beneficial in rare cases, the farmers would not make expensive arrangements for this purpose. Mr. Sidney then read a return of the results obtained in the nine towns he had enumerated, which showed that, in most cases, the application of sewage was profitable, the system most in favour being that of surface irrigation to grass. The hose and jet had been generally discontinued. At Worthing the works were not yet in operation; but they were under the charge of Mr. Rawlinson, who, after great experience in sewage irrigation, was about to apply the sewage of a population of 7,000 to an area of about 400 acres. He had rejected the hose and jet system as an expensive process, from which no satisfactory results could be looked for, and had adopted the open meadow system, applying it to grass crops only. Then, again, on this subject they had the thoroughly practical opinion of Sir Joseph Paxton, whose view was that they must be satisfied with securing a large amount of good out of the application of sewage under special circumstances, without expecting it to be universally applicable. His experience was that he could place the sewage made by 250 persons over an acre of sandy land in a year, and that with very great results as to the growth of plants. Sir Joseph Paxton also stated before the Committee that he had not the slightest notion that small dressings could ever be successfully applied with London sewage. Next, he came to the practical experience of the Earl of Essex, in respect of the sewage operations at Watford, who, in his evidence, stated that he began using the sewage of Watford under the impression that that would be sufficient to irrigate 210 acres, and he underpiped that area of land. The quantity of sewage he obtained, however, was about 60,000 or 70,000 tons a year, and this he now applied to only 10 acres of Italian rye-grass and 35 acres of meadow grass. He put 5,000 or 6,000 tons a-year to each acre of Italian rye-grass, and 600 tons on each of the 35 acres of meadow. After hearing such opinions as these, he (Mr. Sidney) thought they could place but little weight on the opinion expressed by Mr. Walker at the last meeting, that 720 tons a year per acre was a proper application of sewage—an opinion with which Mr. Walker's tenants entirely disagreed. On this subject they had also heard the opinion of his friend, Professor Voelcker, than whom no man more possessed the confidence of the farmers of England. Without disrespect to Mr. Walker, he might say that his absence from this country during a great part of the time these experiments were being made at Rugby, did not qualify him to give an opinion which was entitled to equal weight with those of the practical men whom he (Mr. Sidney) had quoted: and two of Mr. Walker's tenants had told him personally that they regarded the small application of sewage as of no use whatever. Again, Lord Robert Montagu referred to the evidence of Mr. Mechi in favour of small dressings in opposition to what his lordship regarded as the profligate employment of sewage on the part of Mr. Lawes, but he (Mr. Sidney) challenged any one who had visited Mr. Mechi's farm to say that any instance was there shown of the value of liquid manure; because, he ventured to say, Mr. Mechi had never grown a good crop from his liquid manure solely—he had been obliged to use solid manure as well. There was another distinguished name he might mention, viz., Baron Liebig, who had written a letter in the newspapers, telling them that after twenty years' experience on the subject of sewage manure, they were all wrong, and that good farming could be only obtained by small dressings. Now, although Liebig was a celebrated man, and a great chemist, he had never yet meddled with a practical question without being entirely wrong. Twenty years ago he denounced deep drainage for cereal crops, and recommended the introduction of a mineral manure that was to grow all sorts of crops, but it had been a failure. Since then he had informed the world that the system of farming pursued in this country had entirely exhausted the soil. He (Mr. Sidney) asked the farmers of England to be guided by the experience of practical men, such as he had referred to, rather than by the theories of enthusiasts. The view taken by Mr. Morton, as to the best mode of using London sewage, was, he thought, that which would bring as much profit as they could expect to derive, while relieving London of a great nuisance.

Dr. GILBERT said, having had a great deal to do with the Rugby experiments, he begged to be allowed, in the absence of Mr. Lawes, to say a few words in reply to what had fallen from Lord Robert Montagu and Mr. Walker at the last meeting, and also in reference to Mr. Morton's statement as the result of his observation of the Rugby operations. Mr. Morton had stated that, in passing over the fields, he saw one in which there was good sweet herbage, which had been fed off, and in another coarse, couchy grass, which had been mown. Now it was quite evident that Mr. Morton had not been informed of all the facts, or he would not have given the two different modes

of removing the crops as the sole reason for the difference in the character of those crops. The meadow which had been fed off had not received 1,000 tons of sewage annually, and had not supported one-third the stock that the more highly-sewaged and coarser herbage had done, whilst it had received repeated dressings of sewage, and the other none, during the whole of the excessively dry summer of last year. With regard to the change of herbage, it was well known by those who had had the largest experience in Edinburgh, that when they had sown fifteen or twenty different kinds of grass, in a few years, if the meadows were successful, and they gave large crops, they reduced them down to two or three plants, and they could not help it. It was, to a great extent, a question of quantity *versus* quality, and if the object was a large produce per acre, they conld not have the complete herbage of a natural feeding pasture, and no one need attempt to get it. But Mr. Walker, in his evidence before Lord Robert Montagu's Committee, gave a statement as to the rules of action in the conduct of the Rugby experiments, and he (Dr. Gilbert) begged to state that both the rules and the practice were the precise contrary to those which were stated by Mr. Walker. Mr. Walker stated in his evidence that "there was a preconcerted system of watering certain plots at stated times, without reference to those times being just the suitable times for watering the grouud. For instance, there were three plots in each field, and they were to be watered *seriatim* at given times, without reference to whether the grass was just then ready for watering or not. The grass was allowed to grow extremely rank, till it was quite dead at the bottom; then it was cut, and the dry stubble-like stalks left to dry a considerable time in the sun; then, and not till then, it was watered again, and took a considerable time to revive." Mr. Lawes being asked if he agreed with that statement, replied, "I do not say that such a thing may not have happened in the course of the last two years and a half, &c." Now he (Mr. Gilbert) would put it to any gentleman connected with agriculture whether it was possible to sewage any considerable portion of land and have no patches of overgrown crops at times? But on the strength of Mr. Walker's statement, and of the candid admission by Mr. Lawes, that the thing had occasionally happened, Lord Robert Montagu, in his remarks in that room last week, had stated that such was the prearranged rule in the conduct of the experiments. His lordship said, "not only was it wrong from the quantity of sewage put on it, but also from the precise rules which were laid down by Mr. Lawes himself, viz., that at such and such times the sewage was to be applied, and at certain periods the grass was to be cut. The grass grew very long and rank, and rotted at the roots, but Mr. Lawes did not cut it because the prescribed time had not arrived. At last the haymaking time came, and the grass was cut and carted away, while the rotted roots were left to bake in the hot summer sun. The land was parched and cracked, and all the grass worth having was killed." He (Dr. Gilbert) begged to say that, as to the alleged rule of the application of the sewage, there was just some plausible foundation in fact, but as to the alleged rule of cutting, there was none whatever. First, as to the rules of application of sewage. Looking to the fact that the supply of sewage was constant all the year round, and must be disposed of in the winter as well as the summer, it was arranged to apply the quantities fixed upon for each plot, within certain limits, evenly over the year, those limits being entirely dependent on the condition of the grass, always supposing that there was a supply of sewage to be had, which was not always the case, and this was no fault of the Commission. He (Dr. Gilbert) visited those fields during the period of active growth every few weeks, and it was his duty to get an exact record of the amount of sewage applied up to that date, and according to the state of the growth to give directions as to the quantity that should be applied during the next few weeks, so as to give as far as possible the quantity they should receive in summer, at the most advantageous period for the grass. The rule was not to apply sewage when the grass was nearly ready for cutting, and to apply it again immediately the plot was cleared. But it had so happened, more particularly just at the entrance of Mr. Walker's field, where everybody saw it, that the land in that field, being in high ridges and very steep, it had been found very difficult to get the sewage on evenly, although a man was constantly employed in the field to secure that result; portions of the plot had grown very high, while the remaining portions were unfit to cut. Everybody knew that with the exercise of the utmost care it was impossible to get the sewage quite evenly on land so laid out, and that the result must be inequality of growth. From this accidental cause, therefore, it had occasionally happened that the grass on comparatively small portions of a plot had been allowed to remain longer than was otherwise desirable, because the rest of the plot was not fit to cut, and the sewage could not be applied again until nearly the whole was cleared. He therefore begged to repeat that the rules laid down, and practice almost uniformly followed, both as to the application of the sewage and the cutting of the grass, were precisely the contrary to those stated by Mr. Walker in his evidence, and by Lord R. Montagu at the last meeting. His lordship had also endeavoured to give the meeting the impression that Mr. Lawes' practical recommendation to the public was to apply as much as from 60,000 to 70,000 tons of sewage per acre, and his lordship put it to the meeting what was to be thought of the opinions of a gentleman who recommended from 50,000 to 70,000 tons per acre? and in contradiction to this his lordship quoted the statement of Mr. Walker, that on an average he only applied 750 tons per acre. Now Mr. Lawes had, in his evidence, about half a dozen times, distinctly stated that so far as his experience went, about 6,000 tons was the proper amount to be applied to grass land; but after giving that evidence over and over again, he was asked a question by the committee as to what he would do provided he had an unlimited supply of sewage for nothing? to which his reply was—"If I could have it for nothing, and put it on the ground, I would use 50,000, 60,000, or 70,000 tons per acre, or anything you could give me." It was, then, not as Mr. Lawes' recommendation to the public, as Lord Robert Montagu had with such want of candour endeavoured to persuade them, but simply with the view to getting the greatest possible produce per acre provided he were to have the sewage for nothing, that he said he would under those conditions use so large an amount. The following quotations from his evidence showed what was Mr. Lawes' practical advice on the point:—

4562. "I should think that, perhaps, 6,000 tons would be as much as I should wish to use upon an acre, if I could get a suitable district for it."

4565. "I should think 6,000 tons per acre, but it depends a great deal on a number of circumstances, &c."

4567. "Looking to the interest of both parties, I should say about 6,000 tons per acre; as a tenant, I should say 30,000 or 40,000 if you gave me the sewage. If you wanted to charge for it, I should confine myself to something about 6,000."

In conclusion, he (Dr. Gilbert) would ask, what would be the benefit to the ratepaying and urban populations of such unfair representations of evidence on this great question. He would ask, why Mr. Walker, the landlord at Rugby, was examined, whilst his tenants, the men who had lost the money on the small quantity and large area system, were not examined. The evidence of a farmer tenant had, it was true, been taken, and he, being a grazing farmer, and having lost much money by his sewage farming under Mr. Walker, his testimony was that sewage was not good for either grass or arable land. But neither of the present tenants (one of eleven years' experience) had been examined. Mr. Campbell being accidentally at the House on one occasion,

Lord R. Montagu offered to examine him if he wished, but it was for the chairman (Lord R. Montagu) to wish, and not for the witness, so he was not examined. Whatever use might be made of facts and evidence, and whatever schemes might be propounded, unless it could be shown that it was to the interest of the farmers to use the sewage, they would never be customers for it. The subject was essentially a practical one, and practical considerations could not be ignored; and he (Dr. Gilbert) was confident that if sewage could not be delivered on the land at an average of considerably less per ton the year round than had been proposed by sanguine and theoretical persons, the farmers would not use it, and nothing but loss, disappointment, and further postponement of the settlement of this question would result.

Mr. Alderman MECHI said, to a certain extent, they must look for the same descriptions of prejudice on the sewage question as existed in the early days of gas and railways. It might be said to be the great question of the age, because it was quite clear the food of the people of this country depended on properly putting upon the soil human and animal excrement; and if he differed from gentlemen who advocated large applications of sewage to land, it was on this principle, that they had it in evidence that the farmed land of England, in its present form, received the excrement of about two sheep to the acre, and therefore when a sudden jump was proposed to what was equivalent to two or three hundred sheep per acre as the manurial provision it astonished farmers very much. Then there was another view of the question. If his calculations were right, it required the produce of 6,000,000 acres of land to feed the 3,000,000 population of London. It was true they had the difficulty—or what was said to be a difficulty—to deal with, that the manure contained in sewage was mixed up with a very large amount of water, and there naturally arose the question—first, whether the conducting of so large a mass of liquid to the land could be practically carried out with a profit; and, secondly, whether that additional quantity of rainfall—so to call it—would be injurious to the soil? The evidence of eminent hydraulic engineers was that they could raise 1,000 tons of sewage 300 feet at a cost of 13s. to 14s. If they applied that test to the cost of raising the whole of the sewage of London, he could not make it come to more than £500 per day. Now, if they were to believe Liebig, he told them, in his recent paper, that the sewage of London was of the value of £12,000 a day. Baron Liebig had recently addressed a paper to the Lord Mayor of London, for which the thanks of the Corporation would be voted to him, which appeared to exhaust the question as to the value of sewage and the most profitable mode of using it. Arguments had been employed against applying it to certain soils. His friend, Professor Voelcker, said some qualities of land required a great deal and others wanted very little of it; but if they looked at the area of 6,000,000 acres which he had referred to, they would find that nine-tenths of it was so poor that it would bear a double and treble supply of manure. But what did they propose to do on the principle of large applications? It was proposed to denude the great area of the land of the fertility which had been exhausted by the crop, and spread it over a smaller area in the immediate vicinity of the town. He cared nothing for any of the great rival schemes, but he spoke of this only as a great national question. Then came the question whether sewage was best for one crop or for another. The notion seemed to prevail at present that it was almost exclusively adapted to the growth of grass crops. But what did Liebig say on the subject? He said it was a great mistake to put it on grass crops at all, inasmuch as it supplied a large amount of fertilising properties which were not required for grass, but which would be of great value to cereal plants. Mr. Sidney had said that he (Mr. Mechi) knew nothing about sewage! Why, for fifteen years he had put all the excrements of his animals and the sewage of twelve people in his house on his land, and if that, mixed with large quantities of water, was not sewage, animal and human, he did *not know what was*. The great mistake that had been made was applying sewage to slow-growing fine grasses in large quantities, when it should have been applied to rapidly-growing grasses of good quality. Italian rye-grass after sewage was so rich that they did not dare to give a full supply of it to young animals because it would kill them. He had lately had some calves die, and Professor Symonds told him the reason was the extreme richness of the Italian grass on which they had been fed. A practical farmer might regard the long, rank, strawy-looking hay from Italian grass as very poor stuff, but the men who fed horses and fat bullocks upon it said they had never seen their animals in such condition, even when they had the best clover hay, or the best meadow grass. This Italian rye-grass, which was a rapidly-growing grass, was particularly suited to large applications of moisture, for in the dry Midland, Eastern, and Southern counties, where there was not much rain, those who attempted to grow Italian rye-grass never got a second crop, because it absorbed and evaporated such a large amount of moisture; and he could understand perfectly what had been said by Dr. Gilbert, that the application of a large quantity of sewage would produce plants adapted to that large application, for by changing the application they changed the plant; the extent of moisture applied would actually regulate the kind of grass produced. He congratulated the Board of Works in having taken active steps in this matter, and the Society of Arts on the present discussion. It might take some time to settle finally the best mode of applying London sewage with profit and with good results, but in the meantime what he would guard the Board of Works against, was the parting for ever with that which they knew to be valuable. When such a man as Liebig stated the sewage of London to be worth £2,000,000 a year, minus the cost of application, it was a great mistake to give that valuable property away, except for a limited time and under certain conditions. The whole subject demanded serious attention, affecting as it did, not only the ratepayers, but the general interests of the country.

Mr. ROBERT RAWLINSON said he did not like to venture to say much on this subject, because he did not profess to have any intimate knowledge of agriculture, but it did so happen that he had had a pretty wide experience in the examination of districts where sewage works were being constructed, and where sewage application had taken place, and he had also necessarily paid some attention to the schemes which had been propounded for the application of the sewage of the metropolis to land. He had only a few minutes ago heard it intimated, by so high an authority as Mr. Alderman Mechi, that there was a probable advantage to arise to the metropolis in applying its sewage to large areas for agricultural purposes in small dressings. He could only say that, at the present moment, all the knowledge he possessed, and all the experience that had come to him, were in a directly contrary direction; and he also held that if large sums of money were raised by a company, and if the large works planned were attempted for the application of the sewage of the metropolis over hundreds of thousands of acres, he thought that it would only result in bankruptcy. To carry sewage over large areas necessarily involved two things, very expensive lifting power, and very expensive permanent plant below the surface for the so-called distribution. Where the application of sewage had been a success he found that it was in cases where it had been applied in large dressings, in the simplest possible manner, over comparatively small areas, with no price paid for it, and with very simple apparatus. In Edinburgh there was a very limited area, about 400 acres, receiving the refuse of a considerable portion of the city, which came down without any cost, without any fettering conditions as to how, when, or in what way it should be used. The

greatest possible results were thus produced from the land so treated; but in the town of Leith, clear-headed, calculating Scotchmen were going to expend £66,000 in sewering the Leith district; and in the face of a rental of £35 an acre on the opposite side of the city, they were spending this large amount of money to carry the pipes on to the sea that the sewage might there be discharged. If any one thought they were wrong in this, and would like to take the sewage and make use of it, he (Mr. Rawlinson) would be happy to place him in communication with the Corporation of Edinburgh, who would be only too happy to let him have the sewage for nothing. Surely there was something in this, in spite of what Alderman Mechi had said about the necessity of taking the sewage back to the land. Was there no escape from the dilemma otherwise than committing themselves to an extravagant expenditure of money which would not be remunerative? How long would a scheme of applying sewage be carried on if it did not pay? They might manage by some means or other to utilise the sewage in a profitable manner, but to say that the sewage of London, which was the produce of 3,000,000 of people, should be applied over 6,000,000 or even 1,000,000 acres, was an absolute fallacy. In his opinion no such system could be carried out. Then, again, with regard to the mode of applying sewage, he would give them in a rough way the amount which it would cost to pipe the whole area. In round numbers, the cast-iron pipes they would have to lay down would cost a shilling per inch in the diameter for a yard in length. If they took the greatest and most successful examples of irrigation of which they had any knowledge, where large volumes of water had long been regularly poured over the land, producing really great results, such as in the northern parts of Italy, and in some parts of India, they would find that the whole of the water was distributed by canals, open carriers, and open runnels. It might be said that this was water, and what they were now dealing with was sewage, but if they had attempted to distribute the water by underground conduits of cast-iron, the works would have cost 24 times as much as they had done. Lord Robert Montagu had accused him of having given evidence before the Committee which was contrary to his opinions. He could only say that if in giving his evidence he failed to make his meaning clear it was from no dishonest motive; but his own belief was that his evidence and his opinions were in perfect accordance.

Mr. BOWING said he should be glad to accept Mr. Rawlinson's offer to be put in communication with the authorities at Leith, and would gladly take the sewage of that place. As they had heard so often, there were two modes of applying the sewage which were now being advocated by opposing parties, one that of small dressings over large areas, and the other large dressings over small areas. The mode, however, to be adopted was that which would enable the real value of the sewage to be fully made use of, giving the ratepayer his share in this value. For his own part, he believed the sewage was a very valuable property. Baron Liebig and others said that the sewage was worth about twopence per ton. Hofmann and Witt had adopted one method of proceeding, and Baron Liebig another, and yet they all three arrived at about the same result as to the actual value of the sewage. If the sewage were applied in such enormous dressings as 10,000 to 20,000 tons to an acre, as done at Edinburgh, and as proposed by Messrs. Napier and Hope, how was it possible to recover one-fiftieth part of its value? Liebig gave it as his opinion that sand was the last soil and grass the last crop to which sewage should be applied. He did not believe that the Board of Works had had the interest of the ratepayers of the metropolis at heart in what they had done, and it would be a source of satisfaction to everybody if that body would only come forward and allow their plans to be tested. All interested in the matter must be glad that Lord Robert Montagu had again taken the subject up, and that there would be an inquiry into all the plans which had been proposed for the utilisation of the sewage, entirely without the assistance of the Metropolitan Board of Works.

Mr. HARRIS said there was one point which they seemed to have lost sight of, and that was that the Metropolitan Board of Works required the sewage to be taken away so as not to be a nuisance. Taking the sewage of the northern part of the metropolis at the quantity stated, it would be found that if it travelled at the rate of a mile and a half an hour, it would occupy a channel of something like 20 feet wide and 6 feet deep. Here was a small river constantly coming down to be provided for, and which must be dealt with as it came. This was a fact which materially affected the whole question. He would say nothing about the engineering part of the case, but the chemical question was a very important one. It was now generally acknowledged by chemists that the sewage was worth about 6s. per head of the population. It was best to speak of it as so much per head, because if the value per ton were given, the question of dilution entered so materially into the matter that it was impossible to get at anything like correct results. The sewage of Croydon, for instance, was diluted to twice the extent of that of Watford, and of course the intrinsic value of a ton in one case would be double that which it would be in the other. But what did Liebig say in his letter about the sewage in this diluted state? He said, "In the diluted state in which these elements are present in sewer water they are without any mercantile value." The ratepayers of London were the owners of this stuff in its rough state, and the farmers were the manufacturers who had to get the metal from the ore supplied to them by the ratepayers. As far as experience went, he found sewage so far from returning 6s. per head of the population very often did not give back more than 2s. per head. Liebig rated the agriculturists in his letter for paying twice the value for guano. He told them that they were being deluded by the chemists of the country, and were giving £13 a ton for what was worth only £6 or £7. For his own part he did not believe that the agriculturists of Great Britain were so foolish, and that they would not continue to give such a sum for any article if they did not find that they got a *quid pro quo*. In comparing sewage with other manures, it must be remembered that they could apply other manures when and how they pleased, but they had to take the sewage throughout the year and apply it every day. Sewage was an exceptional manure, and the only persons at all who used manure in a manner analogous to that in which sewage should be used were market gardeners, who, near London, sometimes applied 70 tons of manure per acre to their land, which quantity contained twice as much phosphoric acid and twice as much potash as 7,000 tons of sewage, and about two-thirds the quantity of ammonia. If, then, they looked upon market-gardening as the highest form of agriculture, they must allow that the application of 7,000 tons of sewage per acre could not be considered excessive. Baron Liebig stated in his letter that if a possibility was offered to the farmer to get back as sewage those matters which he had carried as food to the town, that was to say, if he gave his fields the same, both in quantity and in quality, which had been taken from them, their fertility might then be assured to an endless number of years, but was there a possibility of doing this? They had a plan before them by which it was proposed to apply the sewage of the three million of inhabitants of London to about 530,000 acres. If they applied this principle to the whole of England and Wales, the population being about 20,000,000, they would find that the whole amount of sewage would require about 3,500,000 acres of land, whereas the total acreage of England and Wales was about 37,000,000; and thus on the most extensive plan proposed only about a tithe of the whole of the land could receive the benefit of the sewage, and what was to become of the other nine-tenths? Baron Liebig stated that we were now refreshing our land and keep-

ing up our produce by the application of large importations of guano, which supply would very soon cease, and that our land would then go out of cultivation, and we should be reduced to a state of famine. This was a conclusion to which they might fairly come from Liebig's statement. But was there any such fear for English agriculturists? He believed not, for if the supply of guano should fail, he had no doubt they would exercise their ingenuity in discovering some other material which would answer the same purpose.

Mr. WM. HAWES said he quite agreed with the remarks of Mr. Alderman Mechi as to the great advance which this question had made, and he believed that there were plenty of gentlemen to be found in England who would take the matter into their consideration, and, after they had formed their opinions upon it, would support those opinions by their capital. In this way experiments would be made, and in the course of a few years he had no doubt that they would arrive at the solution of the problem, and would find out the best mode of applying sewage to the land. He did not believe that they would much longer neglect the great lesson which Providence had taught them, that of returning to the soil that which they had previously taken from it, and enabling it to reproduce the same materials. It was a question which required time, science, and capital. They must not disregard either of these, and if at any time, even during the present session, any new information could be obtained, or old information be supported by new arguments, the Society of Arts would be very glad to give an opportunity for re-opening the subject.

Mr. STUART BARKER, after expressing his satisfaction at hearing Mr. Morton's valuable paper, and alluding to the various schemes which had been proposed, said his own experience led him to the conclusion that the best means of applying sewage was by ordinary irrigation, and that by this method they could obtain a maximum result at a minimum of cost and labour. He had applied the sewage on a farm by means of a hose and tap, and scarcely any beneficial result had followed, but he afterwards cut an open drain and the result was immediately perceptible in the increased quality and crop of grass. If they were to commence the work again there was no doubt that some improvement might be made, but it must be recollected that the sewage of London was now at Barking, and that it could not be brought back, but must be dealt with under existing circumstances. If it was not allowed to go into the river as at present proposed, then it must be carried farther down the river. There was no reference in the paper to the application of sewage at Carlisle, where the experiment had been highly successful. A mode of deodorising the sewage, and applying it to the land had been adopted. The population was about 22,000, and the sewage was applied to 70 acres. During the last 30 years we had been violating the natural law, that what was taken from the earth should be returned to it again. Of late years, instead of putting the refuse of our towns on the land, we had thrown it away into the rivers, where it had been prejudicial in every respect. The connexion which necessarily existed between the application of sewage and the drainage of land, was most important. If sewage was to be applied in quantity, the land must be thoroughly drained in order to carry off the water, and unless this were done we should, by the frequent application of large quantities of sewage, convert our meadows and lowlands into so many marshes and bogs. But in many cases, where there was sufficient fall, and the pipes were large enough, the drains might be made to answer the two-fold purpose of draining the land and of conveying the sewage to any part of a field where it might be required. This might be accomplished by connecting the upper end of the drain (covered by a grate) with the carrier or feeder, and by means of plugs and spout drains, placed at intervals, the sewage might be thrown alternately over various portions of the land. The advantages of this plan would be that sewage would be economised, and that the land at the lower end of the field would not receive the sewage which had already passed over the upper portion, and which had therefore lost much of its fertilising power, but would derive its supply fresh from the drains. We should not then see, as we frequently did now, a luxuriant crop at the upper end, and a deficient one in the lower part of the field, but the crop would be equally good throughout. In many positions, too, hydrants and hose and jet might thus be dispensed with, and the whole plan could be carried out by a small addition to the ordinary cost of drainage. This, he might say, was not a mere theory, but a plan which he had adopted in water meadows with success. He was glad to see that Lord Robert Montagu was again going to bring forward in Parliament the subject of the application of town sewage.

Dr. BACHHOFFNER said that the appointment of another committee to inquire into this matter was the very last thing he should like to see, if it was to be such a committee as they had had before. The two schemes proposed reminded him of the opposing systems of homœopathy and allopathy, and his own experience led him to prefer the allopathic course of treatment—he preferred large doses of manure to small areas of land. As had been said, the sewage of London was already at Barking, and could not be kept there, but if the small dosing system were adopted, they would be obliged to deodorise it there, and turn it into the Thames. When they considered the millions of money which Londoners had spent to take the sewage to Barking, was it common sense to spend millions more to have it brought back again? In his opinion no system could be successful which did not use every atom of the sewage at such a distance from London that it should not be a nuisance to the metropolis. A great deal had been said about the value of London sewage, but the experiments which had been made by Dr. Hofmann and Mr. Witt had no value as regarded London sewage. The analyses were quite correct as far as they went, but they did not go far enough.

The CHAIRMAN said that, at that late period of the discussion, he should only enter into the subject to correct some grave misapprehensions. Mr. Walker had stated that the General Board of Health, or had implied that he (the Chairman) had at the outset recommended the application of a certain quantity of sewage—5,000 gallons per acre. He had made no recommendation of the sort. What he had done with the principle from the first had been to recommend trial works on every occasion for its application, both on account of the great diversity of soils (as noticed by Professor Voelcker), as well as of the various crops. Then, again, the kind of sewage, and the extent of its dilution, were matters of importance. In writings, and in this discussion, sewage manure had been assumed to be very much of one quality. In one town, however, the supply was at the rate of 300 gallons per house, the greater part of which was waste, (at Croydon, for example,) whilst in another on the constant system, the supply was not more than forty gallons per house. Then, again, no care had usually been taken as to the sort of soil-pan or water-closet introduced to ensure the least quantity of water being used for cleansing and conveyance, and consequently for dilution. In some, half a gallon of water sufficed, in others two gallons or more were used. Instructions had early been given to intercept sewage from old natural water-courses, and to prevent subsoil water, or surface water, getting into the sewers, sending the rainfall proper from the uncovered portions. In London, under a proper system of engineering, the old natural water-courses, the Old Bourne, the East Bourne, the West Bourne, would have been restored to their natural functions, and storm-waters would have been conveyed to the river through them; instead of which they had been treated as sewers, and made to discharge storm and subsoil water into most expensively and unnecessarily enlarged intercepting sewers. Hence the

condition of the sewage in the dry weather flow, in wet weather, and in storms, was widely varied. In one condition it would be valuable, in another so diluted as to be comparatively valueless. It had yet to be taught that internal care as to the adjustment of the apparatus for its collection and removal, was needful to preserve it in the best condition for its regular and efficient application. Again, by most chemists even, no distinction had been made of the wide difference between fresh and putrid sewage. Yet the difference was extreme. Professor Voelcker had proved, that throughout the country the farmers wasted full one-third of the farm yard manure by not using it fresh. The difference in efficiency between fresh and putrid sewage was even greater. The matter contained in the water discharged as sewage from London was generally a year old at least. It was the disintegrated matter, the overflow of cesspools, or of badly constructed drains of deposit, or sewers of deposit, of which there were some hundred miles in London, constantly giving off effluvia, wasting manure in houses and streets. People complained of the pollution of rivers; where putrid sewage from old town sewers was disharged into rivers it killed the fish; where fresh sewage was discharged it appeared to feed them. At Carlisle, which had been newly drained with pipe drains, it was stated that the fish greatly increased in quantity and improved in quality. At Ely, also, the anglers found their best sport at the mouth of the pipe sewers. So much for the consolation of those who were more anxious for the preservation of fish than for the population of towns. But there was a better use for sewage than feeding fish. In this diversity of the conditions of sewage he had always advised that all outlays should be preceded and governed by trial-works, to determine the extent of land that would absorb a given quantity in ordinary conditions. They should make the trials by the water-pot, or by the water-cart, in measured quantities, to see how much the land, with and without vegetation, would absorb and retain without letting any run off or run through at each dressing. Having thus ascertained the maximum quantity which the particular soil and vegetation would utilise, the next question to consider was, the most economical means of bringing the sewage to the land and distributing it. Iron pipes usually cost about £5 an acre. In some cases, where the ground had a natural inclination, as in Devonshire water meadows, they were laid out for less than that, but in general the water meadows cost much more to form; at Edinburgh they cost more than £16 an acre, and some of the Duke of Portland's water meadows, near Mansfield, cost as much as £100 an acre. In Lombardy, even, they often cost as much as £40 an acre; people had visited and looked at such places without inquiring either into the original outlay or the working expenses, and talked of the easy and natural flow of the water, without considering how much of it flowed away unapplied, which was commonly more than half. On some of the Edinburgh meadows the very rent of the space occupied by the sluices and carriers would, it had been declared, pay for the rent of the pipes and the expenses of distribution by steam power, by which, if properly conducted, as great an effect would be produced with one-third the quantity of sewage. If, however, those who had adopted steam and pipe distribution, whether for farm or town manures, had been guided, as they were generally advised, by previous trial works, they would have found that with high cultivation (which was the cheapest) one-half, or even one-third, of the pipeage or area of land would have sufficed. Trial works, well conducted and well observed, would settle the chief controversies raised. The persons to conduct such works should not be mere practical farmers; but the persons best qualified to work the land on such trials were market gardeners; and they should be guided in the application of the liquid manure by horticulturists who grew prize fruits, who were accustomed to the feeding of plants, and practically acquainted with the applications of liquefied manures, and who knew the right times and seasons for applying repeated doses to stimulate growth. In such hands far different results would be produced than those described in Mr. Morton's paper. When he was in Paris some time ago, he had the honour to speak to the Emperor on the subject, when he submitted that his Majesty's officers ought to conduct for themselves trial works for dealing with the sewage of Paris; they did so, and impartial persons would acknowledge that these trials were the best that had been made; they were conducted by Professor Moll, of the Conservatoire des Arts-et-Metiers, assisted by Mons. Mille, ingénieur-en-chef of Paris. These gentlemen, with others, came over to this country, and examined for themselves the chief works, at Watford, Leicester, and Rugby, the liquefied manure farms, and the Edinburgh irrigated meadows. They decided against the application of sewage by the method of submersion, and adopted in preference the method by steam and pipe distribution. Mr. Morton had written an English Encyclopœdia of Agriculture, while Professor Moll, who occupied an analogous position in France, had written a French Encyclopœdia on the same subject. He was, moreover, eminent as a practical agriculturist. He had conducted an experimental farm for the application of the sewage of Paris, and on this he had written a very able paper, embracing the whole subject of the application of the sewage of towns to agricultural production. Ill-health had obliged him to quit the farm, but he had recently written a letter, in which he had said that a practical experience for five years had made him more and more a partisan of his (the Chairman's) system of distribution, as the best means of applying the sewage manure of towns to land.

Mr. WALKER (of Rugby) wished to say a word or two in explanation. About 12 or 13 years ago, he and others had been led, by the report of the Commission, to believe that 5,000 gallons per acre was a fair quantity. This opinion was founded upon the reports of the various engineers who had inspected the works then existing in different parts of the country. The results varied from about 2,800 to 6,000, and, therefore, 5,000 was taken as being about a proper quantity.

The CHAIRMAN said it was now his pleasing duty to propose a vote of thanks to Mr. Morton for his valuable paper. He was sure they would all tender their thanks to him.

The vote of thanks having been passed,

Mr. MORTON acknowledged the compliment paid to him.

MR. J. BAILEY DENTON writes:—As I had no opportunity, on Wednesday evening last, of saying a few words, and shall be absent on Wednesday next, I will ask you to insert the following remarks upon two points which I think have not received the attention that is due to them. In the first place, the full development of town sewage, as now practised, is dependent upon a copious supply of water, and a complete extension of the water-closet system, and, therefore, the supply of water to towns is a matter of the highest moment. It follows, upon this admission, that every town should not only look out for itself to have a sufficient quantity of water, but that it should not dispose of its own sewage in such a way as to injuriously affect the water supply of other towns. Now, if we study the regime of our rivers, it will be seen that their flow depends upon the tributary influx of waters which are now being used, and will be used to a greater extent every day, by towns; and that if that use is to be converted into an abuse, by entire abstraction, if not by pollution, the question arises which of the two is the greater evil. To apply this question to the present discussion, we have only to suppose that the effect of irrigating land with sewage is to absorb the whole by vegetation and evaporation, which will certainly be the case if the

irrigation takes place between April and October. What, then, is to become of the rivers which lose this water? Depend upon it this is a great and important point, and that any mode of dealing with the sewage of towns which has not regard to the water economy of the country will not be a lasting one. In the case of tidal rivers, like the Thames at London, it may be out of place to refer to this, but we must remember that what is done in London will be taken as an example for all other towns, and that the water question in its several aspects is one inseparable from sewage. In the second place, I wish to draw the attention of the Society to the fact that great efforts, by highly scientific men, in France and Germany, are now being directed to such a modification of the water-closet system as shall separate the water, in a great measure, from the excrement, so as to allow the one to return, innocuous, to rivers, and the other to be arrested in such concentrated condition as to be really serviceable as manure. This separation is effected in the water-closets by having a pipe to receive such surplus water as is not required for lubricating the excrement-pipe, and conduct it away into the sewers, while the excrements themselves are conducted by another pipe into tanks, from whence, having been purchased, they are removed. Mons. Mosselman, of Paris, has an ingenious plan of using quicklime so as to absorb the fluid excrements, and thus he converts the urine into solid without the loss of the ammonia. Though I cannot say that this mode of treatment is at present applicable to London, where a system of sewerage has been established inconsistent with any separation of the valuable part of the sewage from the bulk, yet I can well understand that the French plan is applicable to towns not yet sewered; and I know of no reason why householders should not withhold their sewage from the sewers if they can sell it, and thus the value of the bulk discharged by the sewers will be reduced. What, then, will become of those works which depend for their success on the value and utilization of the whole discharge of towns? I put these questions thus categorically because I feel that although the pollution of our rivers calls for immediate consideration, the abstraction of water never to return to the rivers is a matter of equal importance, and that any application of science which will allow of the return of the water into the rivers, after the valuable ingredients of sewage have been appropriated, is the object to which we ought to look, and not, in our hurry to get rid of a troublesome matter, take it for granted that science will never discover some means of adjusting the question to the requirements of all interests. To render my note apposite to the discussion, I should state, as immediately bearing upon the sewage of the metropolis, that some years back I investigated the Essex Marshes, and am enabled to state that at least 9-10ths of their extent must be under-drained before they can be profitably laid out for irrigation; and, I may add, as a fact capable of proof, that to irrigate the marshes of any low-lying valley is to increase its unhealthiness, though that may be greatly mitigated by under-drainage. I do not lay stress upon the increased evil of irrigating with sewage instead of water, as it must be manifest to everyone that miasma, which is due to the deleterious matter evolved with water under the influence of the atmosphere, is more likely to arise from the putrid matter of the London sewers than from the clearer waters which are generally used for irrigation. At this time I am engaged in superintending the conversion of water meadows in a well-known valley into dry meadows, because they are found unhealthy; and it seems the reverse of discretion to make the wet meadows in the metropolitan valley still more wet by irrigation, and apply sewage for the purpose, when the neighbourhood is already known to be subject to fever and ague.

Mr. WALKER, of Rugby, writes:—The great pressure for time last night prevented my replying to Dr. Gilbert, though I could only repeat, on the evidence of my own sight and that of all the neighbourhood, that the land was treated in the way I had described—not in places here and there, but the whole of it—and systematically. Dr. Gilbert cannot deny that the sewage was running off one part almost unchanged, while other parts were thirsting for it, one part being flooded while another part was baked. He does not and cannot say that the waterings were regulated so as to follow immediately on the mowing. He does not and cannot say that the grass was not left lying in masses on the ground long after it was fit to cut, and when it was quite white at bottom. He cannot deny that the reason given for such delay in mowing was that the regulation cows kept to test the feeding and milk-giving quality of the grass were not ready for it. I went on the land time after time, and always found the same thing, and Mr. Campbell (employed to see to the measurements, &c.,) told me the days fixed for the various waterings. It is true these waterings could not always be given for want of material, but this only made bad worse. Mr. Morton did not describe the herbage as spoilt in isolated exceptional places, but generally; and if anyone entertains any doubt, the fields are only half-an-hour's walk from the Rugby station, and may be seen at any time, and they would carry the conviction that there is not the slightest foundation for Dr. Gilbert's assertion that it is only in exceptional places that the good herbage was destroyed.

Mr. JOHN BETHELL writes:—As this is a subject which I have for years studied as a manufacturing chemist and as a farmer (having farmed a large farm), I venture to send you my opinions. It is an established fact, that if you return to an acre of land the excreta of men or animals that have eaten the produce of that land, you will not only retain the land in its fertility, but you will increase this every year, because the land will absorb from the atmosphere some extra fertilizing properties beyond that furnished by the manure, so that under such circumstances it will increase in its fertility. This has been well proved in China and Belgium, where the most careful attention has been paid to the subject, so much so, that in Belgium, domestic servants on being hired reserve to themselves the power of selling their excreta, which was generally contracted for at £1 per annum, and of course it must be admitted that if the excreta of the inhabitants of London could be collected and applied to the land, as was done in Belgium, a large annual value would be derived thereby. Professor Liebig values it (I believe) at 6s. per head. But this is in my opinion surrounded with immense difficulties, when applied to London sewage. Chemists are too apt to look to the important facts above stated, without sufficiently considering the different circumstances under which London sewage is collected. The excreta of a human being, valued by its solid particles, does not exceed 1 lb. per day, and by the provision of our water supply to houses this is mixed with thirty gallons of water per head, or 300 lbs.; but this is not all, because you must add to this the washings of the streets, which will increase it to 400 or 500 lbs. of water to one lb. of excrement. Now we know, as chemists, that if this mixture remains for some days before it is distributed on the land, the animal matters putrefy, and give birth to ammonia and soluble phosphate, which are dissolved by the water, and held in suspension by it, so that all the manuring properties are in the water, and the solid contains none; and as we have only the ammonia and soluble phosphate generated from 1 lb. of excrement mixed with 400 lbs. of water, such solution will be so very weak, that unless it is applied in very large quantities it will be of little service to the land. And then you must consider that in doing this you must cover the land with an enormous amount of water, which in many cases may be detrimental. The beneficial results obtained by Alderman Mechi and others were realised under different circumstances. Their liquid sewage did not contain anything like the extra quantity of water which exists in London sewage

There is another great difficulty, which I think the Board of Works will find to be a most serious inconvenience to them, and a matter of enormous expense. They propose (I understand) to send the sewage to large tanks at Barking, where it is to remain until the solid particles subside, and then to run off the liquid into the Thames. Now this solid matter will be composed, chiefly, of the débris or small particles of stone, iron from horses' shoes, &c., all of which is utterly valueless as a manure; and it has been proved that no farmers will cart it away, even if it was given to them, as it is not worth the cost of cartage. But what will they do with it? It will soon amount to many thousands of tons; and if it is taken out of the tanks and heaped up it will still contain sufficient impurities to cause a very noxious vapour in the atmosphere, which may be seriously injurious to the health of the neighbourhood. I mentioned this in the Chemical Section of the last meeting of the British Association (1864), and the chemists present agreed with me in thinking that this was a most serious difficulty. If the liquid parts of the sewage of London were separated from the solid, and then by proper regulations, applied to certain descriptions of land, it would no doubt be very valuable, but then how are you to dispose of the sediment, or solid particles of stone, iron, &c. I do not think this has been sufficiently considered, but in my opinion it is most important to do so. Then as to the nature of the soil to which it should be applied. Professor Way showed us some years ago that if you filter water containing ammonia, &c., or putrid urine, through land containing a certain amount of clay, the clay absorbs all the ammonia and manuring property in the liquid, and then he stated that nature, by its wonderful chymical power, made from these compounds of clay and manuring properties a nourishing food for plants, but when the same liquid was filtered through sand, or earth not containing clay, the ammonia and manuring properties passed through the soil unchanged, and therefore no food for plants would be produced thereby in that soil. In the former case the putrid urine liquid was collected at the bottom of the filter as pure water, freed from all manuring or noxious smells, but in the latter it passed through nearly unchanged and as stinking as before. Presuming this to be correct, what would be the value of manuring the Maplin or any other sand with liquid sewage; and what profit would be derived by depositing on the sand particles of granite and iron from the London streets? None whatever. If they could mix with the Maplin Sand clay, and then apply liquid manure, a beneficial result would be obtained, but the cost of applying this clay would be great. The late Professor Buckland often stated that Woking Common could be rendered fertile by covering it with a stratum of clay, which he considered could be brought by rail and spread on the land at such a cost as would pay. If this was done, then London sewage distributed over it would be extremely beneficial. I make these remarks with the hope that gentlemen working on this subject will consider them, as, when the objections are correctly known, remedies may be suggested.

Proceedings of Institutions.

BIRMINGHAM AND MIDLAND INSTITUTE.—The programme for the winter term includes lectures on "The Socialistic Schemes of St. Simon and Fourier," by Dr. Hodgson; on "The Relations of Great Men to Women," by Mr. George Dawson, M.A.; on "The Life and Writings of Sydney Smith," by Mr. J. Bickerton Williams; on "The Re-production of Natural Forms by Art and Manufacture, having special reference to Art Metal Work in Birmingham," by Mr. B. Waterhouse Hawkins, F.L.S., F.G.S.; and "A Few Words on English Poets, with Selected Passages," by Lord Lyttelton. Classes in many of the principal subjects included in the Society of Arts Examination will be regularly held. Penny lectures will also be delivered, the subjects being, "Optical Instruments," by Mr. C. J. Woodward; 'Natural History," by Mr. B. Waterhouse Hawkins, F.L.S., F.G.S.; "The Human Body, its Functions, and How to keep it Healthy," by Dr. Alfred Hill; and "Colours, their Appearance in Nature and Production by Art," by Mr. Alfred S. Johnstone.

SHEFFIELD LITERARY AND PHILOSOPHICAL SOCIETY.—A conversazione was held in the Cutlers' Hall on Thursday, February 2nd, under the management of a committee, consisting of Messrs. Sorby, Baker, and Stuart. An interesting collection of objects, too numerous to particularise, was exhibited. It may, however, be mentioned that Mr. H. C. Sorby, F.R.S., of Sheffield, showed various spectra of fresh and old blood, illustrating a new method of detecting blood stains; stains of various kinds on linen, &c., as illustrations of the spectrum method in detecting minute quantities of blood when other methods would fail; and microscopical photographs of various kinds of iron and steel. Mr. Abel, Royal Arsenal, Woolwich, showed specimens of various fuzes for firing guns or for blasting by means of his ebonite exploder, for field use. Messrs. Day and Son, of Lincoln's-inn, showed a facsimile in photozincography of Shakspeare's first folio. Mr. Ellis, of Sheffield, showed specimens of a new method of photographic printing so as to make the contrast of light and shade not so objectionable, and some incised disks rotating by the influence of magnetism induced by the earth. The evening was enlivened by music.

WESTMINSTER WORKING MEN'S CLUB, DUCK-LANE.—The fourth anniversary of this Institution was held on Thursday evening, the 15th December, and passed off most successfully. The lecture-room was filled with working men. The chair was taken by Sir R. Carden, who was supported by the Rev. Canon Conway, the Rev. J. B. Owen, the Rev. T. Wright, J. G. Gent, Esq., Judge Payne, &c., and the committees of the Club and Temperance Association, and members of the singing class. Mrs. Cooper and Miss Adeline Cooper were also present. Mr. Edward Stephens, the secretary of the club, read the report, from which it appeared that the club was commenced, with one room, in December, 1860, an upper room being acquired and added in December, 1861; and in November, 1863, an adjoining house was taken, and the whole building remodelled to meet the requirements of the members, 1,040 of whom had been enrolled on the books; but as some had left the district, there were about 800 members, with an average weekly attendance of 240. The Institution was managed entirely by the members; the rules had been well observed, and not a book or periodical had been taken away. The educational classes had been of great benefit to the members, and they deeply regretted that Mr. Jewell, on account of increase of business, was compelled to cease his attendance; the Bible Class would shortly be resumed, and the members' thanks were offered to the Rev. Mr. Wright, who had so ably conducted it; thirteen lectures had been delivered on a variety of interesting and scientific subjects, many of them illustrated with diagrams, chemical experiments, &c. In the penny banks the deposits had been £81 4s. 1d., and from the commencement, in January, 1861, £232 1s. 9d., of which £215 1s. 3d. had been withdrawn. The enrolled Labour Loan Society had seventy-nine members, with a capital of £112 14s. 2½d. The loans granted during the year amounted to £228, in sums varying from 10s. to £13, and there had been in circulation, since the commencement of the society in July, 1861, £748 18s. 10d.; there had been no defaulters, only one summons having been taken out but never served. 259 temperance pledges had been taken, and £7 5s. had been paid into the sick fund (one penny per week); £5 11s. 3½d. had been paid in sickness, and there was a balance of £7 9s. 8½d. in

the treasurer's hands. The Barrow Club for costermongers had furnished fifteen members with barrows, who, at the expiration of fifty weeks, had become proprietors of their barrows, instead of going on all their lives paying 1s. 3d. or 1s. 6d. a-week for the hire of one. Allusion was made to the recent death of the club-room keeper, Mr. George Marchant, whom, as a mark of respect, the members had carried and followed to his last resting place in Brompton Cemetery; also to the expected loss of the club, through the improvements (so-called) which were causing the destruction of large numbers of their dwellings, forcing the members to crowd into the few poor houses left them, to the destruction of every moral and religious feeling, as they were excluded from the large model buildings erected on the site of their dwellings, either on account of their occupation or from the rent being beyond their means. The report concluded with the warm thanks of the committee and members to Miss Adeline Cooper, the foundress of the Institution, for her untiring care and zeal on their behalf, and to the many friends who had so kindly assisted them at all times. The Chairman (who was received with great applause) said he was glad he had called on Mr. Stephens to read the report first, as it really contained all that he could say about the excellence of the club. He could not realise the fact that so useful a building would be swept away, but certainly ample compensation ought to be made, so as to obtain an equally comfortable one. As regarded the dwellings of the poor, they had much cause for complaint, and he considered Mr. Peabody's money had not been properly employed, as the rents only suited those who had regular incomes of £1 15s. or £2 a-week; what the poor wanted was more dwellings with two rooms, one for the males and one for the females, at a rent of 2s. or 2s. 6d. a-week; when those were obtained we might be said to have made a step in the right direction. The Rev. Mr. Owen, Mr. Deputy-Judge Payne, and others addressed the meeting.

Fine Arts.

BUST OF MR. SASSOON.—Mr. Thomas Woolner has completed the clay model of a bust of the late Mr. David Sassoon, which is to be executed in marble for the Bombay Museum—an Institution which has largely shared in the munificence of a man who, if not widely known in this country, is famous throughout the extent of China and Japan, as well as India, Persia, and Turkey, for his exercise of charity and benevolence. To him is owing the endowment of a Reformatory and Industrial Institution at Bombay, a Public School for boys and girls, and a Synagogue at Bombay, as well as another at Poonah. The Sassoon Hospital at Poonah is one of the most costly and beneficent of his works. A Mechanics' Institute at Bombay, cemeteries there, as well as at Shanghai, Poonah, and Hong-Kong; a free poor-house at Poonah, together with substantial encouragements, in the form of almost unlimited contributions, to every benevolent and charitable undertaking on behalf of humanity, may be mentioned as some of the achievements of his life.

THE POURTALES GALLERY.—The coming dispersion of this famous collection is creating a great sensation in Paris. It is one of the most important private galleries in France, and indeed in the world, especially in antiquities small bronzes, enamels, ivory carvings, medals, and miscellaneous articles; the pictures and sketches are not remarkably numerous, but they are very choice, and include some magnificent works. The late Count Pourtalès Gorgier erected an elegant building for the reception of this fine museum in the Rue Tronchet, near the church of the Madeleine, and in this almost every article was to be seen in the most advantageous light. By will, he directed that the collection should not be sold till ten years after his death, hoping, it is said, that the whole would be purchased by the French government and thus be kept together. This has not occurred, and in a few days the auctioneer will have to decide the destination of its remarkable and varied contents. The sale will occupy about thirty days, extending over the three coming months, and there is no doubt that the concourse of amateurs will be almost unprecedented. The gallery has been open to view four or five days; on the first three by ticket, and afterwards to the public at large, and the rooms have been literally crammed by the fashionable, the artistic, and the curious. How the gallery will be made to accommodate the amateurs, agents, and the public who will flock to it is a riddle. An unpleasant circumstance happened on the last day of the private exhibition; a cup and vase of exquisite Florentine bronze were stolen, and in spite of the doors being closed and strict search being made for suspicious characters, no clue was obtained to the culprit, who escaped with his booty.

FLANDRIN EXHIBITION.—It is decided that the collective exhibition of the works of the late Hippolyte Flandrin, which is to take place in the gallery of the Ecole des Beaux Arts, in Paris, shall be opened on the 15th of the present month, and closed on the same day in March.

MONUMENT TO MARSHAL MONCEY.—The monument which is about to be erected on the spot where the Barriee of Clichy formerly stood, to commemorate the bravn defence made there in 1814, and which has already bee a referred to in the pages of the *Journal*, will be of n different kind to that first projected. It will resemble id some degree the beautiful fountain in the garden behin the great central market of Paris, in part originall designed and executed by the famous sculptor, Jean Gougon, who fell in the massacre of Saint Bartholomew, and also the tomb of Casimir Périer, in the cemetery of Père la Chaise. The statue of the marshal will be placed under an architectural canopy or *édicule*, with open arches on the four sides, and the events which the monument is intended to record will be represented in bas-reliefs on the base. This is certainly a great improvement on the proposed allegorical group of the marshal, surrounded by a soldier, a pensioner, a polytechnic scholar, and an *ouvrier*, supporting the genius of France, and is likely to prove a great ornament to the *Place* it is to decorate. Unfortunately, it is to be disfigured as a work of art by four lions' heads spouting water into as many basins below. The model, one-fifth the size of the intended monument, is now to be seen at the Hôtel de Ville.

Manufactures.

STEAM IN FRANCE.—The Government of France has just issued a decree materially altering the regulations laid down in 1843. These were not in accordance with the growth of machinery and trade, and very irksome to those against whom they operated. In 1850, there were but 6,832 steam engines in all France; in 1863 there were 22,516, representing a force of 617,890 horse-power, or nearly that of two millions of horses in reality, and which is set down as more than the force of all the men in the kingdom capable of labour. Under such circumstances, and the greatly extended practice and increased knowledge of engine-makers, the old regulations had become quite inapplicable. The new decree greatly simplifies the legislation on the subject. The testing of various parts of the machinery officially, till now imperative, has been done away with, except as regards the boiler, which will in future have to be proved up to twice the effective pressure of the steam. Steam engines are no longer to be regarded as dangerous machines, and may henceforth be set up without authority from the officers of government, and without any other form than a declaration of the fact. Boilers are, as heretofore, divided into

three classes, according to their capacity and the pressure to be employed; the regulations concerning the first class are greatly simplified, those of the second class may be set up in any factory or workshop not connected with the dwelling houses of other parties than the proprietor, his family, and workpeople, and the least dangerous class may be introduced even into houses occupied by any number of separate families; and even with regard to other cases, the consent of the neighbours is sufficient to set aside the regulations. Another important provision of the new law is, that all steam boilers shall consume their own smoke, six months grace being, however, allowed for the necessary arrangements to be made. There are other clauses well worth the attention of governments and sanitary boards.

AGRICULTURE IN FRANCE.—The condition of agriculture in France is undergoing the same changes as the trade and commerce of the country, and offers a wide field of study. A new green crop, called *Brome*, has recently attracted much attention, in consequence of the perseverance of M. A. Lavallée. A farmer at Trappes, M. Dailly, has produced 31 tons of green brome per hectare (or more than 12 tons per acre); M. Benoit, of Azy, obtained 35 kilogs. from 200 grammes of seed, or 185 times in weight of the seed; another farmer got 74 kilogs. from one kilogramme of seed. It is claimed for the brome that it promises to feed three bullocks where two were fed before; a magnificent prospect for the beef eater as well as the beef grower. The plant is well known in China, and the Minister of Agriculture, at the instance of M. Barral, the editor of the *Journal of Practical Agriculture*, has taken means for obtaining a good supply of the seed. One great peculiarity of the brome is its growth during an amount of cold which suspends all other vegetation, thus affording green food for cattle before and after all other sources are cut off, and fitting it peculiarly for exposed situations and arid soils. Some years since a farmer in the department of Finistère, received some leguminous seeds from America, and has ever since cultivated the plant with great success; this turns out now, it is said, to be identical with the brome in question. Two new varieties of trefoil are also being cultivated; one with white flowers, and being a month later than the other kinds; the other bearing yellow blossoms, and growing vigorously in silicious and almost sterile lands. A new lucerne from China, known there as *Mou-sou*, and described in M. Paulthier's elaborate work on the plants of the Celestial Empire, is also being experimented on, and is said to promise well. It is sown with millet, as lucerne is sown in Europe with oats and wheat, and will sprout even through snow. The leaves are yellowish, and its flowers, red and black, are so brilliant that the plant was at first used for garden borders. A Russian gentleman, M. Skatschkoff, has introduced the *Mou-sou* into the provinces of Odessa, Kasan, and Moscow, and, in spite of the cold, it has succeeded as well as in China.

Commerce.

COAL-TAR DYES.—The trade, which began in 1860, continues to expand, amounting probably at present to from a quarter to half-a-million annually. The colours are magenta, various shades of blue and violet, purple, yellow, orange, and green. The dyes are sent from London to Lancashire and Yorkshire, and various other places, to be used in the preparation of silk and cotton velvets, printed calicoes, delaines, merinos, finished cottons, silks, ribbons, flannels, and fancy and flannel shirtings. An export trade is beginning to China and the United States, the dyes being sent in their solid form to save freight. In consequence of the extensive use of the new article, the market for cochineal, safflower, and common dye woods has no doubt suffered very considerably.

COAL TRADE.—Messrs. W. H. Laird thus write in their Export Coal Circular:—In the year 1860 the Great Float, Birkenhead, was opened, and the Export Coal Trade was removed to that locality from the Morpeth and Egerton Docks, where, previous to that period, coal had been shipped. The arrangements for the trade have been improved; since it was first opened, three staiths, for the shipment of coal on the hydraulic principle, have been erected, and have gradually come into very general use for small-sized vessels, of 500 tons and under, but larger vessels, as a rule, still load by the barrow system. About September, 1863, the Great Low Water Basin was opened, which enabled vessels of the largest tonnage to enter the Float on any tide, either neap or spring; and when the sluicing operation is perfected, it is expected the basin will always be kept free of silt and accumulations of mud. The Great Northern deep water entrances into the Float from the river are expected to be completed in the course of a few months, and will render perfect, we hope, the facilities for ships entering or leaving this magnificent basin of water, and give still further impetus to its export trade in coal. We may give some idea of the progress of Birkenhead, by stating that the business done in coal there by rail in the year 1860 was 236,667 tons, in 1863 it was 427,931 tons, and in 1864 525,665 tons. During the past year Liverpool has made a stride in its coal export trade, not surpassed or equalled by any other port in the kingdom, and Birkenhead has contributed materially to this progress. On comparing statistics, we observe that the exports of 1863 as compared with 1862, from the separate localities, as classified, show:—From north-eastern ports a decrease of 7 per cent.; from Liverpool a decrease of $3\frac{3}{4}$ per cent.; from Scotch a decrease of $3\frac{1}{2}$ per cent.; from Yorkshire an increase of $4\frac{1}{2}$ per cent.; from Severn an increase of $6\frac{3}{4}$ per cent. The total of the exports 7,529,341, in 1863, against 7,694,558, in 1862, showing a decrease in 1863 of $2\frac{1}{8}$ per cent. The year 1864, as compared with 1863, shows a material improvement in the coal trade of the country, more particularly as regards Liverpool and Birkenhead. The total exports from the port of Liverpool in 1864 were 746,842 tons, of which the shipments at Birkenhead have been 313,398, the increase of the port being nearly 30 per cent. as compared with 1863. The comparative statement of exports from each district during 1864 and 1863 is as follows:—From Yorkshire ports a decrease of 1 per cent.; from Northern ports an increase of 3 per cent.; from Liverpool ports an increase of 30 per cent.; from Severn ports an increase of 9 per cent.; from Scotch ports an increase of 11 per cent.; showing on the total exports of the kingdom an increase in 1864 of 544,984 tons, or about $6\frac{3}{4}$ per cent., viz., 8,074,325 tons, against 7,529,341 tons in 1863.

SENEGAL COTTON.—The *Moniteur de la Flotte* contains an account of a successful plantation of 150 acres of cotton in Senegal. The ground was divided into five unequal parts. One portion, extending over 50 acres, was planted with the native cotton of Senegal. After the ground was cleared, well-handled drills were opened six feet apart, and the sowing was commenced at the beginning of August. In consequence of the abundant rain which fell that month, the young plants attained an unusual size. To the west and north of Taouey is a vast tract of land covered with brushwood, which grew to a great height. The ground was cleared with some difficulty, and sown, as an experiment, with seed of Georgian long-silk cotton, Jumel, Louisiana, and Algerian. The ground was selected because the various kinds of cotton could be planted near each other, and from its position it could be more easily inspected. The soil, moreover, is of various qualities—sandy and damp, suited to Algerian cotton, and in other places rich in vegetable matter. The planter began to clear the land on the 16th of August, he finished on the 6th of September, and the ground was levelled to the extent of 40 acres. On the 17th of September he opened trenches 1 foot wide and 8 inches deep. He sowed the seed of the long-silk Georgian cotton in the bottom of the

trench. In this he followed the Egyptian plan, because the long-silk Georgian cotton requires irrigation. The trenches are calculated to retain the water and the consequent humidity as long as possible. The last sowing succeeded perfectly, and by the last accounts the young plants are flourishing. That was the second experiment the planter tried, and it extended over a surface of 24 acres. The planter expected that by the end of October the entire tract would be levelled and sown.

BEETROOT SUGAR.—Messrs. W. Connal and Co., of Glasgow, in their monthly circular, state—By the most recent statistics, the estimates of beetroot sugar, for the whole of Europe, for the season 1864-5, show an increase of from 35,000 to 40,000 tons over the ascertained production of 1863-64, which was 388,094 tons, as will be seen from the subjoined table. It is, however, obviously a crop more susceptible of injury from the weather than that produced from the cane in the tropics. The confident estimate formed in France of a crop for this season of 200,000 tons resulting, so far as the manufacture has progressed up to the latest date, in one not likely to exceed 128,000 tons, illustrates how critical it must prove as a source of supply. The manufacture, however, is followed out with great spirit; and whereas last year there were 364 manufactories at work, there is this year an increase of 33, notwithstanding that, as a branch of industry in France, it is considered to have been unremunerative last year to the cultivator as well as to the manufacturer:—

	1864-65. ESTIMATES.		1863-64. PRODUCTIONS.
Zollverein	165,000	.....	155,180
France	120,000	.....	108,467
Austria	65,000	.....	60,916
Russia	40,000	.....	35,000
Belgium	22,500	.....	20,031
Poland and Sweden	10,000	.....	10,000
Holland	2,500	.....	2,500
Spain	500	.....	—
Total tons	425,500	.....	388,094

With the view of securing a uniform system for duties and drawbacks, a treaty is now under the consideration of the Governments of England, France, Holland, and Belgium, but it is premature to offer an opinion until the scale is adjusted, as to its bearing on the interests of the British refiners.

THE PORCELAIN TRADE IN PARIS.—The gilding and painting of porcelain gives occupation, in Paris alone, to 1,872 hands, including 458 workwomen; the trade is carried on by 187 master-decorators, and produces to the amount of about 5,300,000f. a year, more than 850,000f. worth of which is exported. There are forty-three workmen who earn 8f. a day; five who earn 9f., and four who earn 12f.; but these are the aristocracy of the trade, the generality earning only 5f. a day, when they are employed by a master. As for those who have the presumption o setting up for themselves and working on their own account, there are thirty-three who make less than 2,000f. profit a year, that is, who are actually starving; for their lodging, which must be fit to carry on the trade in, does not cost them less than 1,000f. a year; with the rest they and their family must live and find their clothing. Women generally earn from 2f. to 2f. 50c. a day; the most skilful earn 4f. 50c. at the utmost. The master decorator takes as many apprentices as he can, and it is they, who either get no wages at all or else not more than 25c. or 1f. a day, who do the largest share of the work. Females generally work at home, but their earnings rarely exceed 25f. or 30f. a fortnight.

Colonies.

NEW ZEALAND EXHIBITION.—The province of Canterbury is now rapidly preparing for the Exhibition. It has the merit of possessing the first locomotive railway, and the illustrating of the works connected with that great engineering enterprise will form one of the most striking features in the Exhibition. It is proposed to exhibit, for instance, an immense section of the tunnel that is in the course of construction, with specimens of the rocks for every few feet that has been passed through. The geological strata and mineral resources of the province are to be fully illustrated by most elaborate maps, sections, and collections, both of scientific and economic interest. Maps and plans, showing the system of survey and land sales, proposed railway, road, and telegraphic routes, topographical features of the country, harbour improvements, architectural designs for public buildings are to be furnished, also specimens of lithography and engraving. The display of wools will show the important position occupied by the province in this respect, and enable the flock-owners to compare the produce from different parts of their own province with those of the rest of New Zealand. Works of art, articles of home manufacture, such as cabinet work, saddlery, &c., may also be looked for.

CLARENCE RIVER COTTON, NEW SOUTH WALES.—During the past season a proprietor planted four acres, two acres with New Orleans seed, and two with the Sea Island cotton, by way of experiment. The Sea Island was almost a failure, but from off the two acres of New Orleans 32cwt. of cotton in the seed was picked, which would yield about 1,000lbs. of clean cotton, and at the price obtained for the Clarence River cotton formerly sent home, namely, 2s. 2d. per lb., would give a return at the rate of £57 13s. per acre. Six cwt. of the New Orleans cotton has been forwarded to Sydney to be ginned. The above yield, considering the very wet weather, shows that in ordinary seasons the crop would, in all probability, be much greater.

The MELBOURNE AND SUBURBAN RAILWAY has been purchased, conditionally on legislative sanction, by the Hobson Bay Railway. The consideration for which the property is to be handed over is £267,000. In the construction of the line about £600,000 was expended, so that it is now sold for less than half its cost.

VICTORIAN RAILWAYS.—The traffic returns for the month of October show a total of receipts amounting to £44,710 6s. 7d. against £37,843 4s. 9d., exhibiting an increase for the month of £6,866 1s. 10d.

Obituary.

DEATH OF THE PAINTER COURT.—France has lost an able artist by the death of Joseph Désiré Court. He was a pupil of Gros, and took the prize of Rome in 1821. His best known works are "The Death of Cæsar," now in the Luxembourg, and the large picture of "Boissy d'Anglas," which forms part of the public collection of the town of Rouen, of which M. Court was curator. Some years since he was among the most fashionable, as well as ablest, portrait painters in Paris.

Publications Issued.

L'ECOLE. By Jules Simon. Lacroix and Co., Paris. 8vo.—An important volume by the author of some of the most remarkable works on social economy and cognate subjects that have appeared in France. M. Jules Simon was assistant minister of public instruction during the short reign of the republic of 1848, and earned a name in history by his indefatigable endeavours to raise the educational standard of the mass of his countrymen. He now represents one of the electoral divisions of Paris in the Chamber, and allows no opportunity of pursuing his former labours to escape him. M. Simon is the strenuous advocate of gratuitous and compulsory public education

as embodied in a bill by his friend and chief, M. Carnot, and presented to the legislature in June, 1848. According to the provisions of this proposed law it was imperative upon every parent to give his child, whether male or female, at least primary instruction, and the public schools were to be open to all without charge. To carry out these views, MM. Carnot and Jules Simon were compelled to set down the sum of forty-seven millions of francs in the budget, and in the then state of the finances such figures would have been fatal to the projected measure, which, however, was withdrawn by M. Carnot's successor, M. Falloux, before the committee had presented its report. One clause of this bill alone reflects the greatest credit upon its originators; for the first time in France it placed girls and boys, and male and female teachers, on a level, recognizing an equality of rights as regards instruction and compensation in one as in the other case. In 1850 the Assembly voted a new law, proposed by M. Falloux, which created eighty-six academies, and distributed patronage between the government, the rectors of colleges, and the ecclesiastics. By this law the minimum salary of a common school-master was fixed at 600 francs (£24) per annum, while the payment of school-mistresses was left entirely in the hands of the local authorities. The organic decree of the Emperor Napoleon, in 1852, made little change in the law; but in 1854 another decree took the appointment of common school teachers out of the hands of the rectors of the academies, and placed it entirely in the hands of the Prefects, acting under the authority of the Minister of Public Instruction. Other decrees have since ameliorated the condition of the teachers of these schools, and recognised the claims of school-mistresses to remuneration. M. Jules Simon admits fairly that a good deal has been done during the last ten years towards improving the condition of the schools for the children of the poor, but he declares the system to be still unworthy of the age in which we live. It would be impossible here to follow the entire course of M. Jules Simon's argument; suffice it to say that he complains loudly, not only as to the quantity, but to the quality of instruction afforded, and he relies principally on the following facts and figures, drawn from official documents or other governmental sources, for the justification of his complaints. The minimum amount of remuneration for school-masters is still only 600 francs. After five years' service this is raised to 700 francs, but the Minister of Public Instruction may, if he think fit, raise the payment of one-twentieth of the masters to 800 francs; after ten years' service to 900 francs; after fifteen years, "by way of favour or recompense." The masters' pay ranges, therefore, from £24 to £28 a-year, with a chance of a bonus of £4 or £8 per annum. A superannuation fund has also been instituted, but its means are yet so small that, in 1863, the pensions only amounted to 68 francs (£2 14s. 6d.) per annum. There are in France 19,423 masters whose salary is below 700 francs, and 2,120 supplementary teachers whose pay is below 600 francs. "After five years' service," says M. Jules Simon, "a school-master is in receipt of 1fr. 80c. per day, less than the pay of a gendarme or lowest custom-house official," who, in addition, have food, clothing, and lodging supplied to them. As regards school-mistresses, they now figure in the budget for the sum of 360,000 francs (£14,400), which is employed by the Minister "by way of encouragement and assistance." The sad condition of lay female teachers seems to arise from the competition between them and the members of religious communities, who enjoy a most extraordinary privilege. All other teachers, public or private, are compelled to undergo an examination, and no one can exercise the calling of a teacher without being the possessor of a certificate of capacity. By a clause of the law of 1850, however, any nun or member of a religious congregation devoted to instruction, and recognised by the authorities, may act as a school-mistress without any examination whatever, "letters of obedience," that is to say, a note from the hand of the superior of the establishment being all-sufficient. The sisters are paid only about 300 francs a-year, and the consequence is that a very considerable number of lay teachers—as many as 4,756—are reduced to find themselves in food and clothing, if not in lodging also, for less than £16 a-year. But there is another phase of this question which M. Jules Simon regards as even more serious; the acquirements demanded of female teachers are of the simplest kind—reading, grammar (limited in practice almost entirely to orthography), writing, and the four simple rules of arithmetic—division (says M. Simon) not being very rigidly enforced. Some of the sisters, although not compelled to do so, submit to an examination, and of their whole number 766 hold diplomas, while 12,335 have only letters of obedience, and M. Jules Simon sees no escape from the conclusion that these 12,000 clerical teachers of youth feel themselves incapable of exhibiting their knowledge of the simple elements of education. If such be the case, seeing that about two-thirds of the girls in the communal schools are taught by sisters, it is not difficult to account for the fact that in the last official return nearly 10,000 girls' schools are reported as passable, mediocre, or bad. M. Simon, too, like many other men, protests against the practice of girls who are to become wives and mothers being trained by mistresses who have renounced the world, and have, therefore, no experience in its duties. There are in France more than 52,000 schools, of which nearly 14,000 are for girls only, and rather more than 18,000 receive children of both sexes. Yet there are some 600,000 children who are not supposed to receive any education whatever, while the instruction of the greater part of the remainder is considered by M. Simon to be of the most unsatisfactory kind. "One-half," he says, "of the 4,296,641 inscribed on the school lists are merely nominally at school; they pass three or four weeks on the forms, to quit them in the first days of spring, and return next year as ignorant as ever. The greater number, even amongst the most assiduous, obtain no instruction deserving the name, never learn to read well enough for it to be a pleasure to them, and, at the end of three years or so, become as completely illiterate as if they had never held an alphabet in their hands." To a certain extent, this opinion is supported by the official returns, by which it appears, that in 1860, 37½ out of every 100 men married could not sign their name, and that more than 27 out of a hundred young men, in their twentieth year, liable to the conscription, were unable even to read. M. Jules Simon concludes that "if one-quarter of the population cannot read at twenty, while only about one-eighth of the children do not go to any school whatever, it is evident that in order to read it is not sufficient to go to school." The governmental vote towards the support of the common schools is, for 1865, 6,843,000 francs; the departments contribute 6,582,000; and the communes themselves about eleven millions; and the total cost of the communal schools is rather more than thirty millions a year; the difference is made up by the payments of the parents of something less than a third of the total number of the scholars. M. Jules Simon complains that the amount spent on the people's education is out of all proportion to the other state expenditure, and General A. Morin, at the annual meeting of the five academies of the *Institut*, in August last, produced a comparative statement of the relative amounts spent by various states for war and education respectively, which showed that France stood very low in the scale, ranking below Austria, Prussia, Bavaria, Wurtemberg, Saxony, Baden, and Hanover. M. Jules Simon's book contains a large amount of information, and should not be neglected by any friend of national education.

Notes.

EXHIBITION OF SCULPTURE IN 1865 AT THE ROYAL HORTICULTURAL SOCIETY.—The exhibitions of sculpture

in the Gardens have shown how many beautiful effects may be produced by the combination of sculpture and foliage, and have shadowed forth a new development of the art of sculpture in this country, where it is the instinct of the people to cultivate flowers and gardens. The Council therefore continue the sculpture exhibition for the third year, and announce the arrangements for the year 1865. 1. Out of the exhibition of 1865 the Council will make purchases to the value of five hundred pounds, provided that new and original works of sufficient merit are exhibited under the conditions hereafter stated. 2. As a general rule it is desirable that all works should be finished works in plaster. But works in marble, bronze, terra-cotta, and other materials than plaster may be sent; the price of a separate plaster copy must be stated. 3. The Society especially desires that all works sent in should be distinctly labelled with the name of the subject, and the artist's name and address, together with *the price at which copies may be sold to the public*, in marble, bronze, terra-cotta, and plaster. 4. When a plaster model is purchased by the Council they desire to be informed at what price the artist will supply another copy in marble, or bronze, or terra-cotta, or any other material. The copyright of making and disposing of other copies in marble, bronze, terra-cotta, etc., will remain with the artist. 5. It is especially desirable that the works sent for purchase in 1865 should be life sized models of animals, single figures, or groups of figures, large ornamental vases with bas-reliefs, or ornamental pedestals with bas-reliefs, but not simply bas-reliefs unapplied. 6. The works must be delivered at the Gardens and removed from them at the conclusion of the exhibition free of charge. As respects works proposed to be sent from abroad it is desirable that photographs should be sent before 1st March, 1865. If the work be approved, the Council will pay the carriage to the Gardens. 7. The Council will take the utmost care of the works, but will not be responsible for any accidents arising from any cause. 8. Artists of all nations are invited to send works. 9. All works for 1865 must be sent on or before 15th April, 1865, and must be left in the Gardens until the 30th September.

AN INTERNATIONAL FRUIT SHOW is appointed by the Royal Horticultural Society to take place from Saturday, 9th December, to Saturday, 16th December, 1865, inclusive. The gold medals of the Society will be awarded for the best collection of fruit and vegetables produced in the garden of a Sovereign; also for the best collection of fruit and vegetables grown by any Botanic or Horticultural Society in any part of the world; also, the best and most complete representative collection of fruit and vegetables from any of the colonies; also for the best and most complete representative collection from the Presidencies of India. Certificates will be awarded for separate exhibitions of fruits and vegetables, either fresh or preserved, from all parts of the world. The first, second, and third gold Knightian medals of the Society to the second and third exhibitor who shall obtain the greatest number of first, second, and third-class certificates respectively. The first gold Banksian medal will be given to the exhibitor who shall gain the greatest number of marks, counting first, second, and third certificates as three, two, and one marks respectively.

SCHOLASTIC EXAMINATION.—In France, where so many young men are employed in the public service, the *Baccalauréat*, or degree of Bachelor of Letters or Sciences, is indispensable for any official career, and superior degrees are in many cases insisted on; moreover, at the present moment, the Ministry of Public Instruction is presided over by a gentleman who, but the other day, was a Professor in one of the colleges. Under these circumstances it is not surprising that the systems of instruction and examination in the public schools should, at the present moment, be the objects of serious study and important ameliorations. The Minister in question, M. Duruy, has just issued a remarkable circular upon the subject of examination for the *Baccalauréat*, of which the following is a *resumé*:—

"In no well-conducted school is a pupil permitted to pass from one class to another until he has acquired in the first the necessary knowledge to enable him to follow the second with profit. The *Baccalauréat* is but the last and most important of these examinations. The object is to show that the pupil has obtained from the school what he went there for, on the eve of his entering into public or private life, or of his entering upon a course of higher or special instruction. Is it a mass of ephemeral information that is required?—No! This is the means, not the end of education.—The real object is to cultivate—to exercise—the pupil's mind by an acquaintance with the masters of human thought. Special knowledge is to be obtained in the professional schools. * * * In the *Lycée* we prepare the man. In this distinction consists the whole rule of our national educational system. But if classical instruction—which, with so much reason, is called liberal education—proposes to develope harmoniously all the faculties of man, without regard to any determined direction, it follows that the examination which tests the results of such education ought to be conducted in such a manner as to convince the pupil that the proof is sought in his intelligence and not his memory, and that less importance will be attached to that accumulation of knowledge which will scarcely resist a few months' idleness, than to evidence, furnished by himself, that he has become familiar with the main facts of history—with the great works of the human mind—with good scientific methods—and, above all, that he is capable of speaking and writing with propriety. Is it necessary, for this end, to compel the pupil to repeat at the last moment, by a desperate effort of memory, the whole course of his studies? It is not the matter of the instruction, but the qualities of the mind developed by study; this is what the examination should bring out. * * *Le Legislator* of 1808 was of this opinion, the candidate for the degree was only required to answer on the subject matter of the two highest classes—those of rhetoric and philosophy." The Minister then proposes to return to this state of things:—"To suppress the whole apparatus of programmes; to strengthen the examination by simplifying it. The *Baccalauréat*," he adds, "has a double character; it is not a competition in which the most worthy carries off the only crown; it is simply the evidence of honest study, and the diploma should be given to all whose replies render them worthy to be classed amongst men of liberal education; but it is also a barrier which defends the higher colleges and administrations, public and private, against the incapables; it is the first elementary proof, at the threshold of civil life, and the first practical lesson of morality received by young men. At this time, when attention is being everywhere given to the placing of special education for the arts and industries on solid bases, it would be most unwise to lower the level of general instruction. The people are rising, and more intelligence is now-a-days expended in trade than heretofore was required at the bar. That those who aspire to serve the state, to honour the nation in literature or science, or to conquer public confidence in the liberal professions, may maintain their position in advance, the preliminary studies, on which the rest of life depends, must be rendered more serious, and the University, on its side, must occupy itself with rendering them at once less difficult and more effective." M. Duruy in like manner claims, for the candidate in sciences, that the examination should refer simply to elementary mathematics. In accordance with these views of the Minister, a decree has been issued, by which the examinations of candidates for the *Baccalauréat* are restricted to the subjects mentioned above—"rhetoric and philosophy" for the candidates in letters, and "elementary mathematics" for the candidates for a scientific degree.

MUSEUM OF CARRIAGES.—A curious building is being erected, adjoining the Museum of Cluny and the ruins of the Roman palace of Thermes, in Paris; it is a covered arcade, the arches of which will hereafter be filled in with

glass; the walls are composed, like those of the old palace, of alternate courses of brick and stone, and the roof is covered with tiles cut in geometric forms. The intended application of this structure is the formation of a collection of Italian carriages of the sixteenth century, and probably others. There are three curious vehicles now in the adjoining museum which will form part of the new department.

GEOLOGISTS' ASSOCIATION.—On Tuesday evening, at the ordinary meeting, Mr. S. Carter Blake, F.G.S., read a paper on the "Geological Evidences of the present Domesticated Animals;" and Mr. Wm. Hislop, F.R.A.S., read his third note on "Microscopic Geology." The meeting was well attended, and some interesting remarks were elicited by the discussion which followed the reading of the papers.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted' F.R.S., "On the Applications of Geology to the Arts and Manufactures."
R. Geographical, 8¼. 1. Mr. R. Temple, "On the Basin of the River Mahanuddy." 2, Dr. Bastian, "Visit to the Ruined Cities of Cambodia."

TUES. ...Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. John England, "Giffard's Injector."
Zoological, 8½.
Syro-Egyptian, 7½. Rev. John Mills, "On the Church of the Holy Sepulchre."
Anthropological, 8.

WED. ...Society of Arts, 8. Mr. Thomas Webster, Q.C., F.R.S., "On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions."
Meteorological, 7.
London Inst., 7.
R. Society of Literature, 4½.

THURS...Zoological, 4.
Royal, 8½.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8. 1. Mr. J. Broughton, "New Reaction for preparing Anhydrides and Ethers." 2. Dr. Fraser, "Chemistry of Calabar Bean.' 3. Dr. Crace Calvert, "Action of Silicate and Carbonate of Soda on Cotton Fibre." 4. Mr. S. Highley, "New Electric Lamp Regulator, &c." 5. Mr. J. Spiller, "Oxidation of India-rubber."
Numismatic, 7.
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."

FRI.....Geological, 1. Annual Meeting.
Philological, 8.
Royal Inst., 8. Mr. W. Huggins, "On the Physical and Chemical Constitution of the Fixed Stars and Nebulæ."

SAT.....Royal Inst., 3. Prof. Marshall, F.R.S., "On the Nervous System."

Patents.

From Commissioners of Patents Journal, February 3rd.

GRANTS OF PROVISIONAL PROTECTION.

Books, &c., preserving from fire—71—F. Wiese.
Boots, &c., manufacture of—169—W. Clark.
Bottles, closing the mouths of—132—H. J. Rogers and J. M. Scholfield.
Burners and glasses, petroleum and coal oil—201—M. A. Dietz.
Clasps, &c.—185—A. I. L. Gordon.
Combs, elastic dents of expanding and contracting—189—M. Robinson.
Cooking—150—S. Ballard.
Cotton, machinery for ginning—44—B. Dobson, W. Slater and R. Halliwell.
Crinoline skirts, manufacture of—108—J. Knight.
Curtains, suspension of—193—J. Badcock.
Driving rolls for rolling metals—135—R. A. Brooman.
Elastic mattresses and bedding—99—E. T. Hughes.
Engines, packings of pistons and piston rods of—155—W. R. Foster.
Fibrous materials, ginning and cleaning—191—C. B. W. Hoehl and W. Gunther.
Fibrous substances, machinery for preparing, &c.—130—J. B. Farrar and J. Hirst.
Fire-arms, breech-loading—106—G. H. Daw.
Fire-arms, breech-loading—138—G. T. Bousfield.
Fire-arms, breech-loading—139—J. S. Edge, sen.
Fire-arms, breech-loading—152—W. E. Newton.
Floor cloths, manufacture of—197—J. B. Wood.
Flower box, ornamental—126—G. Colven.
Fluids, presses for the expression of—134—J. Marshall.
Fluids, regulating the supply of—2659—N. N. L. Lonsdale.
Fog and storm signals, &c.—125—T. Bourne.
Folding chairs, &c.—199—T. Brown.
Furnaces—103—M. Henry.
Furnaces—110—W. S. Longdridge and J. Mash.
Gas retorts, apparatus for charging and drawing—142—S. J. Best and J. J. Holden.
Grain, cleaning and decorticating—115—W. Ager.
Grain, mills for grinding and pulverizing—211—A. Stevenson.
Hammers and pile drivers—181—W. E. Newton.
Iron and steel, furnaces used in the manufacture of—173—J. Hewes.
Keys and locks, construction of—92—J. F. Heather.
Liquid manure, apparatus for distributing—100—W. Russ.
Liquids, ascertaining and indicating the strength of—122—R. A. Brooman.
Looms, &c.—153—J. Burch.
Metals, furnaces for smelting—209—W., R., J., & A. Woodward, jun.
Metals, shaping and forging—165—J. A. Shipton and R. Mitchell.
Mules for spinning and doubling—133—W. Rowbottom.
Music, teaching and transposing—102—R. A. Brooman.
Ordnance and gun barrels—213—J. Marshall and H. Mills.
Ordnance, breech-loading—2994—F. A. Wilson.
Phosphates of lime, &c., for agricultural uses—140—R. A. Brooman.
Pianofortes—141—F. H. Lakin.
Projectiles—171—G. A. Clark.
Railway carriages, signal between passengers and guards—107—J. B. Hill.
Railways, communication between passengers and guards—97—I. Goodlad.
Railways, waggons for the conveyance of cattle upon—3174—W. Reid.
Railways, working switches and signals of—147—W. Jeffreys.
Railway trains, communication between passengers and guards of—121—R. Lea.
Railway trains, communication between passengers, guard, &c.—179—W. Mather.
Railway trains, taking up and delivering mails, &c., while in motion—177—W. Clark.
Railway trains, transmitting letter bags and parcels to and from while in motion—187—C. D. Abel.
Roads, construction and paving of—116—T. G. Pagano.
Sails, reefing and furling—148—A. B. Bull.
Sewing machines—13—G. Mascart.
Sewing machines—144—C. T. Judkins.
Sewing machine shuttles—163—J. F. Bradbury.
Ship building—137—J. Betteley.
Ship compasses—128—J. Lilley.
Ships, giving buoyancy to, and the propulsion of—2405—J. Vine.
Shirt fronts, securing studs in—175—C. Searle.
Sleeve links—120—W. H. Richards.
Soda and potash, manufacture of—2876—A. G. Hunter.
Steam boilers—113—R. Lewis.
Steam boilers, preventing incrustation in—119—G. Davies.
Steam engines—111—W. Brookes.
Steam engines—167—T. C. Durham.
Steam engines—183—T. Lester.
Stones, smoothing the surface of—154—J. Coulter and H. Harpin.
Telegraph conductors and cables, coverings for—98—J. Fuller.
Theatres, working all stage scenery in—131—W. Edwin.
Tills—104—G. Gaze.
Tobacco, machinery for pressing and cutting—123—A. V. Newton.
Transmitting and converting reciprocating motion into rotary motion—145—W. J. Cunningham.
Tubes, cast steel and other metallic—3251—W. H. Brown.
Umbrellas, &c.—114—J. Weekes.
Vehicles, registering the distance travelled by—91—C. M. Bathias.
Warp machinery, manufacture of looped fabrics in—117—W. Wilkins.
Watches, construction of—157—C. D. Abel.
Window-blind cord check—195—E. Templemore.

PATENTS SEALED.

1955. W. R. Taylor.	2108. J. Strouse.
1960. C. W. Lancaster.	2665. R. A. Brooman.
1969. W. E. Gedge.	2756. R. A. Brooman.

From Commissioners of Patents Journal, February 7th.

PATENTS SEALED.

1757. T. Boyle.	2020. G. Bedson.
1975. E. and F. Crook.	3024. W. H. Cox.
1976. D. Spiers, A. Boyd, J. Aitken, and M. Gilmour.	2036. W. Hule.
	2043. P. A. L. de Fontainemoreau.
1978. M. Payne.	2142. G. Furness and L. G. Moore.
1988. H. Armistead.	2303. C. H. Robinson, J. Fryer, and A. Dyson.
1995. J. Russell.	
1996. R. D. Edwards.	
1997. J. Lang.	2515. J. Slater.
2000. J. Millbank.	2582. W. M. Ryer.
2007. A. Alison and J. Shaw.	2667. W. Jackson.
2009. H. Dyer.	2854. J. Rowley.
2012. M. Brown.	3042. G. T. Bousfield.
2019. W. Richardson.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

279. W. Clark.	330. W. H. Bartholomew.
283. D. Joy.	374. T. Horsley.
769. R. A. Brooman.	405. W. Avery.
284. C. W. Lancaster.	463. W. Hamer.
290. G. Manwaring.	318. E. T. Bellhouse and W. J. Dording.
320. J. Tonkin.	